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Engineering News-Record

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April 16, 1931

Mechanized Levee Building for the New Madrid Floodway

Concrete Trusses and 47-Ft. Slabs in Seattle Viaduct

Driving and Lining a 6-Ft. Tunnel in Gravel

Water and Sewage Problems of Some Illinois Cities

Mixed-in-Place Road Surfacing in Vermont

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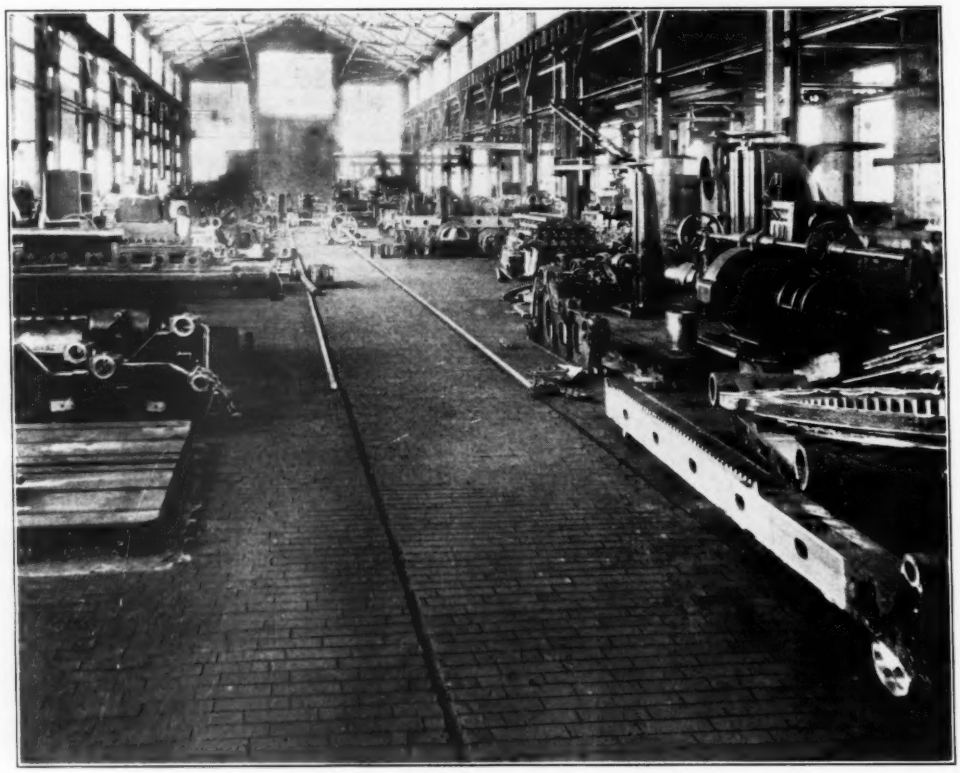

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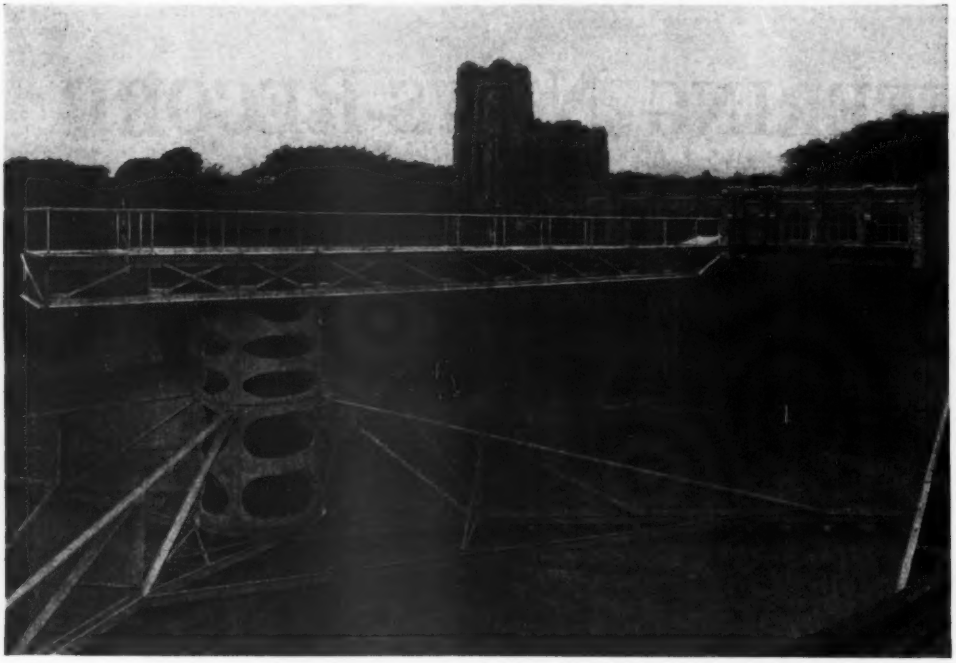

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

F. E. SCHMITT, *Editor*

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Obsolete Equipment

WITH prices for all classes of construction work unbelievably low, as recent bids have shown, contractors who plan to use even a few obsolete equipment units are handicapped from the start. Where much of the plant is out of date or run down, the best of management with ample ability cannot break even at the prices at which work is going. Only with equipment that is suitable and right is there hope for a profit. Present competition among contractors is not much less sharp than that during the depression of ten years ago. But at that time plant and equipment did not play so large a part in the contractor's success. Units were cruder, slower and less dependable than now. The close coordination of equipment that makes the properly planted construction job as efficient as a modern factory had not become general. By taking full advantage of the progress made by manufacturers of equipment in refinements of design during the past few years, contractors have been able to synchronize construction movements within close limits, resulting in important reductions in unit costs. Failure to recognize or unwillingness to acknowledge important changes in equipment design may mean that some contractors will lose heavily on work taken at present prices.

Paying Dearly

SOMETHING like a decade has been spent in litigation between the city of New York and the Interborough Rapid Transit Company, operator of part of the city's subways, over the validity of the operating contract which specifies a five-cent fare. An appellate court decision now upholds the contract. In simple language it says that a contract is a contract. Everyone knew this, and yet the long litigation was carried on to prove it anew. At the start the company made large earnings under the contract, but later on it did not, and then sought to escape the obligation and obtain new terms. To indulge in such lawsuits, evidently, is to pay dearly for learning elementary principles about contractual agreements, which presumably have the same force in business and in law as they do in dealings between man and man. The five-cent fare may be unprofitable today; any fixed fare may become unprofitable at some time, and for that reason may be a bad basis for a contract. But every contract may turn out to be unprofitable to one party or the other, and it is made a contract for that very reason: it binds both parties to its terms even in the event of loss. The company in this instance spent much money to relearn a simple axiom, as have many construction contractors in past lawsuits over unprofitable contracts. There is a long road ahead in adjusting the relations of utilities and public bodies in mutually equitable manner. Unwillingness to honor contracts will make the road longer and harder.

San Francisco's New Charter

NOTABLE features of the new charter for the city and county of San Francisco, adopted by a handsome majority on March 28, are the strengthening of the mayor and the scattering of the engineering work of the city. The latter arises through the creation of a utilities commission, to have charge of the municipal railway, the city water-works, including Hetch Hetchy aqueduct construction, the municipal airport, harbor works if transferred from the state to the city, and any other utilities that the city may acquire. As the city planning commission and its engineer will continue to work independently, the city engineering department will have little responsibility and little or no power to coordinate engineering work except as regards streets and sewers. There is this to be said for the utilities commission plan at San Francisco: It centralizes all utilities, provides for a strong engineering organization and has many safeguards as to financial administration. The new charter is a step in advance, even though it subordinates engineering. A peculiar element of the charter is its mixture of the strong-mayor and city-manager plan, the latter through a chief administrative officer, appointed by the mayor and controlling only a few departments, all singleheaded. This is an experiment worth watching.

Safe Versus Safer

HOW far may a contractor be expected to go in assuring the safety of his work, especially as regards temporary supports and underpinning? Is there not a limit of normal, sound engineering judgment to what may be asked of the contractor, beyond which he is entitled to extra pay? These questions, often the cause of dispute between engineer and contractor, were again raised by a recent suit for extra compensation on a contract. The case was that of a subway contractor in New York City, whose work required him to support the columns of the elevated railway in upper Eighth Avenue while building the subway structure below. He proposed an underpinning structure of four pipe piles, apparently satisfactory to the city's engineers, for eight piers were supported in this manner. But later, on the demand of the elevated railway company supported by the city's engineers, he changed the method to a more expensive six-pile support. In his suit to recover the extra cost, a jury found in his favor. Regardless of merits, the

case demonstrates the difficulty often confronting the contractor of meeting an undefined requirement to the satisfaction of the engineer, or, even worse, to that of a third party. Since the above-mentioned incident arose, the city board of transportation has included in its specifications a statement of underpinning methods that will be satisfactory. This does not mean that the contractor cannot substitute different methods (if approved by the engineer), but it gives him something upon which to base his estimates. Similar practice might well be adopted on many projects; it would eliminate one more uncertainty in contracting.

Planning With Models

IN PRIMITIVE times probably all works of man were merely built; that is they were laid out right on the site. In a later era sketches and models were the startingpoint of a piece of construction. We have progressed mightily in the drafting of plans, and for many years virtually everything has been built from drawings. But with all his conceiving brain and seeing eye the designer does not always picture reality in its three dimensions perfectly. Even today, therefore, the model has a place as a useful working tool of design. The times are bringing it back into favor. A New York skyscraper is not alone detailed in a thousand drawings, but a model is made to show owner and lender how it will look. A Chicago intake crib is modeled to bring out the full complexity of its parts and their interferences—flotation chambers, screens, living quarters, all of which must fit together in a minimum of space. A Detroit power station has its steam-pipe layout built in model to afford a true conception of its arrangement to engineers and draftsmen. Intricate structural work is many times worked out more effectively in solid model in the templet shop than on the drawing board. In these cases from working design practice, and in the many instances of educational models, we have a useful reminder of the effectiveness of this method of bringing the finished product to view. The architect is more familiar with it than the engineer, but perhaps the latter can make even greater practical application.

Significance of the 1930 Drought

LESSONS not to be lightly overlooked are found in the record of failing water supplies written into the annals of water departments in many towns and cities of this country last season. Municipal water-supply systems to be adequate must be designed to provide sufficient water through annual as well as seasonal variations in rainfall and runoff. To do this at reasonable cost they must have a small margin of safety beyond the requirements for the worst conditions on record. When, as in 1930, the record is exceeded, the planning of years may need to be reconsidered in the light of new facts. Herein lies the significance of the 1930 drought, a significance extending far beyond the drought region.

New low-flow records for many rivers and streams in this country were established in a broad belt centering on the Ohio and Potomac rivers and extending from the Osage River in Missouri to tidewater in Maryland and Virginia. In Arkansas, Tennessee, Mississippi and Louisiana the drought was limited to the growing season, tragic enough for agriculture but not serious for public water supply; but in the eastern part of the area the drought began during the closing weeks of 1929 and continued up to the early part of 1931.

The promptness with which a decrease in streamflow in those regions followed the onset of the rainfall deficiency depended upon runoff characteristics and the adequacy of groundwater reserve. In West Virginia, for example, stream discharge began to decline sharply in December, 1929, and finally reached unprecedentedly low figures in the fall of 1930. Several streams in that state dried up completely even at points where the contributing drainage area measured more than 1,000 square miles. Where more propitious subsurface conditions existed, streamflows were maintained by groundwater reserves for months after the surface runoff had ceased to be significant. By midsummer, however, low streamflow was a general condition throughout the affected region; despite recent rains it persists even now in some localities.

The first public water supplies to experience distress were those on the smaller watercourses, where no impounding reservoirs had been provided. The next to suffer were the communities depending upon impounded storage. Many of these had never before questioned the adequacy of their supplies. Communities depending upon shallow wells were among the early sufferers, but those possessing deep wells did not generally feel the effect until near the end of the drought. Whether some of them will suffer this season because of last year's deficient rainfall remains to be seen. There are indications that they may.

In addition to these effects upon the quantity of water the drought also had an effect upon the quality even in communities where the quantity was not seriously affected. For example, cities drawing their water from the now completely canalized Ohio River found that the conversion of the river into a series of lakes in which sedimentation is much more effective than in the past had provided micro-organic life a particularly favorable environment, especially under the abnormally high temperatures which existed through most of the drought season. Increasing concentration of sewage and industrial wastes assisted the micro-organisms in producing objectionable tastes, difficult to remove. The hardness of water in streams which depended chiefly upon groundwater for their reserve supplies increased greatly, and in the mining districts the acidity of mine drainage brought trouble to communities which found themselves forced to fall back on such sources for all or for an abnormal part of their supplies. Along the Eastern seaboard, cities which draw their supplies from tidal streams found salt water ascending far above previously recorded points; in some instances salinity increased to the point of making the supply unfit for use.

Having learned the inadequacy of their supplies in the hard school of experience, communities in the drought regions may be expected to profit by the lesson. But what of towns and cities elsewhere? How many of them could go through a long period of a like deficiency of rainfall? It is for them that the record concluded in this issue should be of value. If the rainfall over some states can fall far below the supposed minimum, it can do so in others. If cities in the latter states are to profit by the experience of their less fortunate neighbors they should stop now to take stock of their own supplies.

What effect would a 30 per cent decrease in rainfall have on their supplies; what reserves have they, and can they be increased at a moderate cost; where could they

turn for an emergency supply in case of drought before new supplies can be made available, and where can new supplies be had if the present ones are inadequate; are their water-purification plants capable of carrying an increased load due to an increase in hardness or pollution? If the lessons of the 1930 drought are to be made fully effective, these and related questions should be answered by every community in the country.

Gains From Long-Range Planning

SPEAKING to the stockholders of the Pennsylvania Railroad W. W. Atterbury, president, said: "Your company should anticipate years in advance the facilities and improvements required to meet the necessities of the public, and to do this on a scale justified by past experience, keeping in mind the changes taking place in the industrial world, the improved methods of transacting business and the advancement in the science of transportation, involving large outlays of capital expenditures."

In that definite statement of the need for long-range planning, General Atterbury did more than give voice to an untried theory; he spoke from a knowledge of the advantage that such advance planning has brought to the Pennsylvania Railroad in the past and of what it can bring in the future. Back in 1928 the company laid down a plan for the electrification of its principal lines on the Eastern seaboard, which if carried out according to schedule would be completed four years hence. In a similar way it laid down plans for other major undertakings, such as the reconstruction of the passenger terminals at Philadelphia. With such long-range planning and scheduling ahead of construction work, it was able to keep the engineering studies and financing well ahead of actual field necessities.

The economies already made possible by these considerations alone warranted the advance planning. But during the past year other elements have entered into the picture. The business depression brought with it lower prices for materials, increased efficiency of labor, cheaper money and a decrease in traffic which makes possible more intensive construction without undue traffic interference. Because the railroad company had plans all worked out for the work for the next four years it could take advantage of these favoring conditions. The schedule of work is therefore to be speeded up so that construction will be completed in 2½ years instead of four. The cost of the work will be lowered, the money to finance it can be obtained at advantageous rates, and the economies which will result from the new and improved facilities are to become effective a year and a half ahead of the original schedule. Incidentally the spending of $175,000,000 in a period of 2½ years instead of four will help to raise the country out of its depression.

What the Pennsylvania Railroad is doing is paralleled in the work of a few forward-looking companies scattered over the country. It could be duplicated by many others if the same thought were given to the future. It is a concrete example of the need for such planning as outlined in the "Platform for American Business" recently offered by the McGraw-Hill company and more fully set forth in the plans outlined by the dean of the Harvard School of Business Administration in his recent book "Business Adrift." No untried theories are involved; what is needed is vision and the courage to disregard periods of temporary depression.

An Equipment Triumph

A NOTABLE analysis of construction methods and equipment practice on the longest continuous levee in progress on the Mississippi flood-control work is published in this issue. The 35-mile New Madrid floodway levee operations are typical of general experience on the river. Except in a few instances, all of the other Mississippi River levees are being constructed by one of the five types of plant that are building the eleven-million-yard floodway embankment. Everywhere, as on the floodway work, experimentation in new machines has been active and almost a complete failure.

The outstanding facts after three years of intensive development in levee-building machinery are: (1) Standard earth-moving equipment commands the work. (2) New equipment has failed to win and hold a place. This was not expected when the work was begun. It was believed by many that the greatly increased size of the new levees would prove existing equipment inadequate and that entirely new devices must replace many of those long in use. Actual experience has been the opposite. No new machine has been successful. Old devices, greatly improved and in larger sizes and better array, are building the flood-control levees at unprecedented speed.

The explanation is that the possibilities of improvement and new combinations of existing equipment had been underestimated. Construction conditions—particularly ground, weather and water conditions—had not been properly appraised. Contract limitations were even more misappreciated. Virtually every new device offered for levee building has failed because it could not operate economically in shallow borrowpits, could not meet the requirements for dry fill, could not operate in wet ground without miring, and would not stand up under continuous heavy work. Inventive genius has failed totally to perceive practical necessities.

On the other hand, at the beginning of the new levee work there was efficient equipment for excavating, transporting and placing earth. These were the elements of levee building; it required no other functions of equipment. The machines that had been used on the levees—whether mule-team wagons loaded by axle-operated elevating graders, slackline cableways, dragline excavators, or dredges—performed all these functions, and moreover had proved their ability to do so under the exacting conditions of ground, water and contract requirements. The only different requirement presented by the new levees was that larger volumes had to be handled from greater distances, which merely required substituting the greater speed of tractor and railway haulage and increasing the mobility, reach and capacity of dragline and cableway excavators. Hydraulic dredges required no changes.

The floodway levee work thus epitomizes equipment development. No new earth-moving device is a major factor in the work, but every old one is a highly improved mechanical product compared with the machines available when the present flood-control work was begun. It is in this accomplishment that equipment engineering has performed its greatest service. Combined with construction ingenuity in devising new equipment formations and operating plans, standard earth-moving equipment is creating records of moving earth into embankment that have seldom been surpassed. The Mississippi levees are a monument to the equipment manufacturer as truly as to the engineer and constructor.

Constructing the 35-Mile New Madrid Floodway Levee

Graphs of five equipment processes in placing 11,000,000 yd. of earth in levee embankment ranging from 8 to 22 ft. in height

By T. T. KNAPPEN
Engineer, First Field Area, Memphis Engineer District, Cairo, Ill.

LEVEE CONSTRUCTION under a variety of soil and water conditions and a notable local drainage problem characterize the construction of the New Madrid floodway of the Mississippi flood-protection works in Missouri. The back levee, 35 miles long and containing over 11,000,000 yd. of fill, cuts across the natural drainage. This required diversion on a scale which made ditch work and bridge construction a task comparable with levee building. The levee work itself represents practically all the modern methods employed on the Mississippi and some of the most notable developments in levee-building equipment. With the operations scheduled for practical completion this year and all the designs and methods established, the following description by the area engineer in charge is virtually definitive. —EDITOR.

IN PREPARING the plan for the flood control of the Mississippi River, a situation requiring special treatment was recognized in the vicinity of Cairo, Ill., at the confluence of the Mississippi and Ohio rivers. The map (Fig. 1) shows the old levee system.

Through the 70 miles from Cairo to New Madrid, the river is confined to a narrow flood channel some 3 miles wide. It was felt that the levees were already as high as was consistent with safety to Cairo with its 15,000 inhabitants. The solution provided in the flood-control act was to widen the flood plane in times of extreme flood in the bottleneck stretch between Cairo and New Madrid. This widening constitutes the New Madrid floodway.

The first step in the creation of the floodway is the construction of the back levee from Birds Point, opposite Cairo, to a point near the termination of the front-line levee on the east bank of St. John's Bayou, opposite New Madrid. As the floodway is intended for use only in times of extraordinary flood, the front-line levee will be left intact but will be lowered from its present grade (the equivalent of 58 ft. on the Cairo gage) to the equivalent of 55 ft. on the Cairo gage for a distance of 11 miles at the upper end and 5 miles at the lower end. This work of cutting off the top of the levee to make the fuse plug section remains to be done after flowage rights have been acquired.

The drainage of the counry in the vicinity of the setback levee is generally southeast across the line of the levee. As an incident to the acquiring of right-of-way and constructing the levee, it is necessary to provide an intercepting drainage system to carry the water in back of the levee to its existing outlet in St. John's Bayou. A second article will describe the drainage system constructed at a cost of $500,000. Present plans contemplate completion of the project by the end of 1931. The construction cost, exclusive of rights-of-way and flowage rights, is approximately $3,000,000 for levees, and $500,000 for drainage. The right-of-way required for the project is about 3,000 acres, and the area of the floodway between the existing front levee and the new back levee is 130,000 acres.

Construction Methods and Contract Data

The 35 miles of levee construction was let in the fall of 1929 and the spring of 1930 to six contractors (Table I). The levee on the first two contracts, 4-A and 4-B, is of the type 1 section, shown in Fig. 2, which is the standard levee section on the Mississippi in most soils. On contracts 4-C, 4-D and 4-E type 2 section is used. This is a landside borrowpit with a berm varying in width to suit conditions; the variations used are shown by Fig. 2. The average haul on these contracts is about 400 ft., as against about 250 ft. on the first two.

The average contract price on the first two sections was 17.8c. per cubic yard, and on the last four 29.8c., varying from 25 to 36.75c. The reasons for this increase are: the haul, which is about 60 per cent longer and generally would increase the price about 40 per cent; the heavy clearing and grubbing required, increasing the cost about 2c. per cubic yard; the borrowpits, which had to be excavated accurately to ditch section; and the fact that the work, particularly the lower end, is subject to flooding by backwater and is largely in low-lying poorly drained country.

Construction With Draglines in Series

Long-boom dragline excavators operated in series, one handling to the other, were employed by the contractors for sections 4-A and 4-E.

Section 4-A—This section of levee, 10 miles long and containing 1,990,000 cu.yd., is largely through cleared and cultivated land. The contractors were the J. J. McCaughey and the States Contracting Co., of Chicago. The predominating material is heavy black clay, locally known as gumbo, which is sticky when wet and charac-

CONTRACTORS, QUANTITIES, PRICES AND CONSTRUCTION PLANS, NEW MADRID LEVEE

Section	Contractor	Quantity, Cu.Yd.	Unit Price	Section Type	Equipment
4-A	J. J. McCaughey and States Contracting Co.	1,990,000	20c.	1	Draglines in series. Tractor and team wagons.
4-B	Clarke Brothers Construction Co.	2,056,000	15.75c.	1	Tower machine.
4-C	J. C. Johnston Co.	2,153,000	25c.	2,AandB	Tractor wagons, trucks, cableway excavators.
4-D	James G. Yeate Co.	2,169,000	28.5c.	2,ABC	Industrial railway team and tractor wagons, draglines in series.
4-E	J. H. Boyce Sons Co. and Roy L. Igo.	970,000	35.75c.	2,ABC	Dragline in series
4-F	Wilbanks & Pierce, Inc.	1,762,539	32.47c.	3	Dredge with auxiliary dragline lines.

teristically breaks into large clods. This material shades off to a lighter clay known as buckshot, which tends to crumble when dry. Some sandy loam and silt is also encountered. The levee section is comparatively small, averaging only about 3,500 cu.yd. to the station. There is, however, considerable variation in height, the upper 4½ miles averaging about 15 ft. and the lower 5½ miles about 9 ft. Type 1 section (Fig. 2) is used throughout. The swell of the material offsets the shrinkage required; roughly speaking, the net yardage placed in the levee section is about equal to the borrowpit yardage.

This contractor is using a dragline unit on 90 per cent of this work. Fig. 3 illustrates the method. The main machine is a steam dragline with a 145-ft. boom and a 6½-yd. bucket and is mounted on four trucks, which travel on two parallel lines of standard-gage track. The track is carried on mats 13 ft. long, and 26 are used.

Realizing that all the fill must be handled by this machine the contractor sought means to force through it the largest possible yardage. There appeared three ways to speed up operation. One was not to use the machine for dressing; the usual practice is to shape the levee with the digging bucket. It was considered that this work would be better done by a small dragline with a long boom; and a dragline with a special 65-ft. boom and a 1-yd. bucket was obtained. This machine (100-hp. gas engine) shapes the riverside slope and builds out and dresses the landside slope.

The second method of saving time was to shift track with a tractor. Draglines commonly shift track sections with the boom, losing a considerable amount of time. On this job a 60-hp. tractor is used whenever the ground is not too soft; it also hauls coal and does miscellaneous work, such as hauling a grader when required.

A third source of lost time is in triple-tracking to rehandle dirt beyond the reach of the machine in a single swing. Through the upper 4½ miles about one-third of the material was out of reach. To place this material in reach, a 90-ft. dragline with a 3-yd. bucket was installed. This dragline is on trucks and uses ten 16-ft. single-track sections; it has a 120-hp. horizontal diesel engine. Normally the 90-ft. dragline throws the dirt within reach of the 145-ft. boom dragline in one tracking, and always without rehandling. On levee more than about 16 ft. high it has, however, been necessary for it to take more than one cut. Since it must necessarily triple-track, it has also taken a triple cut, although a double cut would in most cases suffice. Fig. 3 shows the operation of each of these three machines in building the levee.

A consistent monthly production of about 150,000

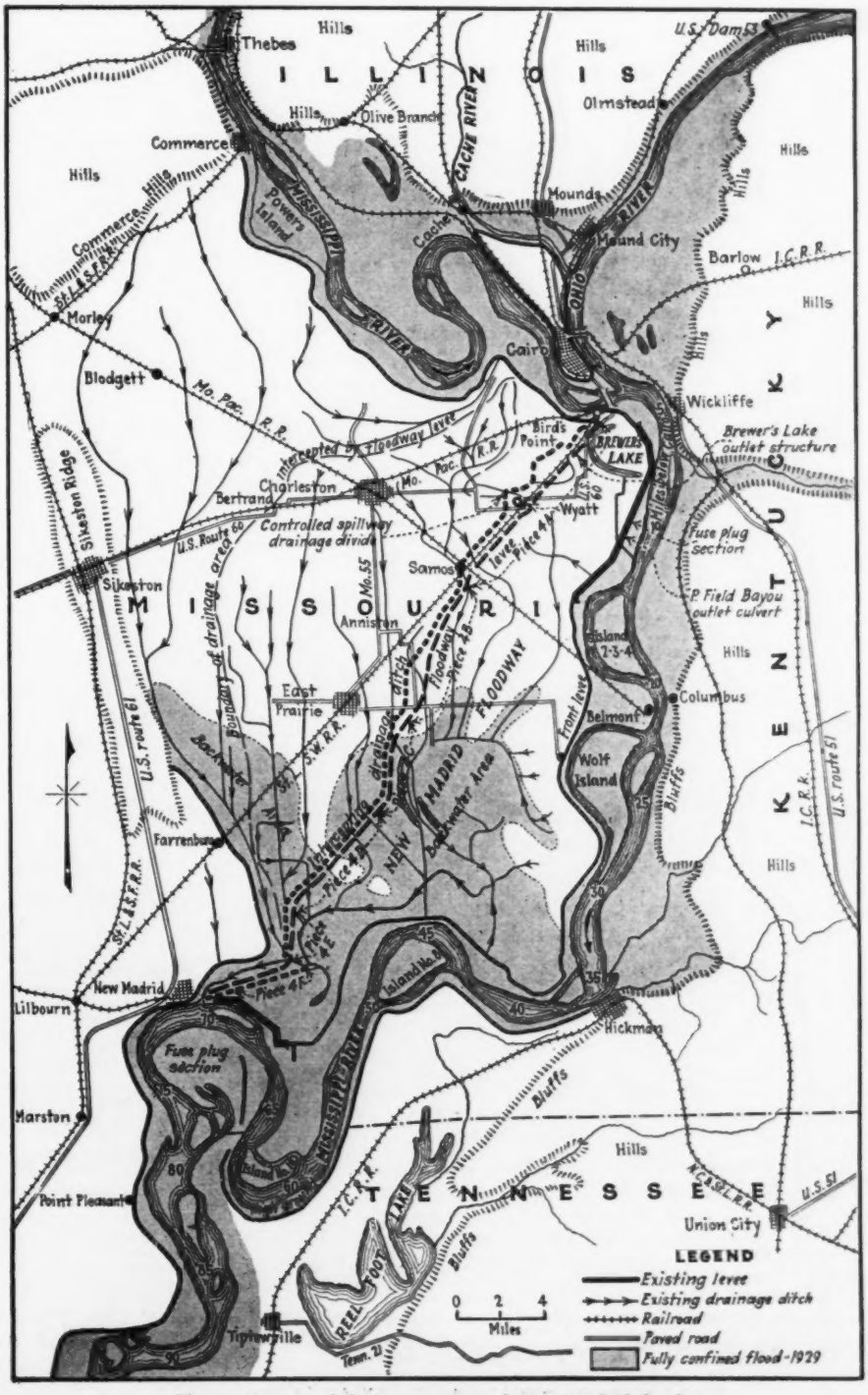


Fig. 1—Levee and drainage system of New Madrid floodway

cu.yd. has been maintained. This can be expected on a levee from 17 to 18 ft. high with materials that give an average amount of swell. To build higher levees, a rehandling unit of longer reach and larger capacity would be required. On a portion of contract 4-D this contractor has employed as subcontractor a longer-boom dragline for rehandling, because of the larger levee section. Without the 90-ft. rehandling unit a levee about 12 ft. high can be built, and with the same production figures. This work has been under the direction of Frank McCaughey, with Shelby Boorhem as general superintendent.

Section 4-E—This section, under contract to J. H. Boyce Sons and Roy L. Igo, contains 995,000 cu.yd. and is being handled by Mr. Igo personally. The material is largely clay with some sand pockets. The clearing and grubbing were very heavy. The levee is type 2, A, B and C (Fig. 2), and has a fairly uniform height of 22 ft., averaging about 7,500 cu.yd. to the station.

The contractor employed one 135-ft. walking dragline with a 6-yd. bucket and two smaller walking machines with 70-ft. booms and 3-yd. buckets. His general operating plan was for the two smaller machines to throw over to the large machine which roughed-in the levee. Then one of the small machines walked over the fill and shaped and dressed the levee. The last operation was to drag the levee with a heavy drag. Favored by exceptionally dry weather, this contractor has placed an average of 140,000 cu.yd. per month. This outfit is very efficient for hauls to about 400 ft.; its successful operation, however, depends on careful management.

Construction With Tower Excavator

The second contract section (4-B) was equipped with the latest pattern tower excavator or slackline cableway levee machine. The levee is 8½ miles long, contains 2,056,000 cu.yd. and varies from 8 to 22 ft. in height. The material ranges from sandy to heavy gumbo. Through a considerable length the top soil is underlaid with a water-bearing sand that renders pit conditions unsatisfactory for most equipment.

The contractors, Clarke Brothers, of Clinton, Ia., T. J. Clark in charge, adopted an electric tower excavator. This machine will build continuously a levee of any height up to about 22 ft. net without auxiliary equipment. The equipment illustrated by Fig. 4 and consists of a head tower equipped with motor-driven hoisting drum, a motor generator set which transforms the line current of 4,400 volts a.c. to 400 volts d.c., and an auxiliary gas engine for propelling the tower when the power is not connected, usually when moving to a new location. The mast is 120 ft. high. The 1⅝-in. track cable passes over a 56-in. sheave in the top of the mast, and the 1½-in. drag cable passes over a sheave of the same size, the height of which may be varied from 40 to 60 ft. The operator's cab is above the drag sheave. The head tower is mounted on four four-wheel trucks traveling on two lines of standard-gage track.

The 30-ft. tail tower is on crawlers and is propelled by a gasoline engine. It has a sheave for the rehaul cable when one is required. There is also a drum for storing the unused portion of the track cable; this permits lengthening the track cable and also shifting it so that the place of maximum wear near the head tower may be changed to prolong the life of the cable. On spans of more than 650 ft. a rehaul is necessary to get the bucket to the back of the pit. The rated line speed of the drag cable is about 500 ft., and of the rehaul cable about 1,500 ft. per minute.

Shifting the head-tower track sections for a machine of this type is a serious problem. Other tower machines have used two booms at the back corners to pick up and relay the sections. On this machine the contractor built a frame at about deck level with an arm extending out over each line of track on both sides. These arms are tracks on each of which two chain blocks travel. They are connected around the ends of the machine by curved sections, so that a track section may be picked up by the chain blocks on one side, pulled around to the other side and set down. The machine is not stopped to shift track. It is propelled during operation by a jaw-clutch power take-off from the main-drive shaft.

The machine is electrically operated and can be used most advantageously when in the vicinity of high-voltage transmission lines. At this location, however, there was no line within reach that could furnish the power required. The contractor, therefore, installed his own generating unit at the town of Anniston, about opposite the middle of the job, 1 mile from the levee and on the

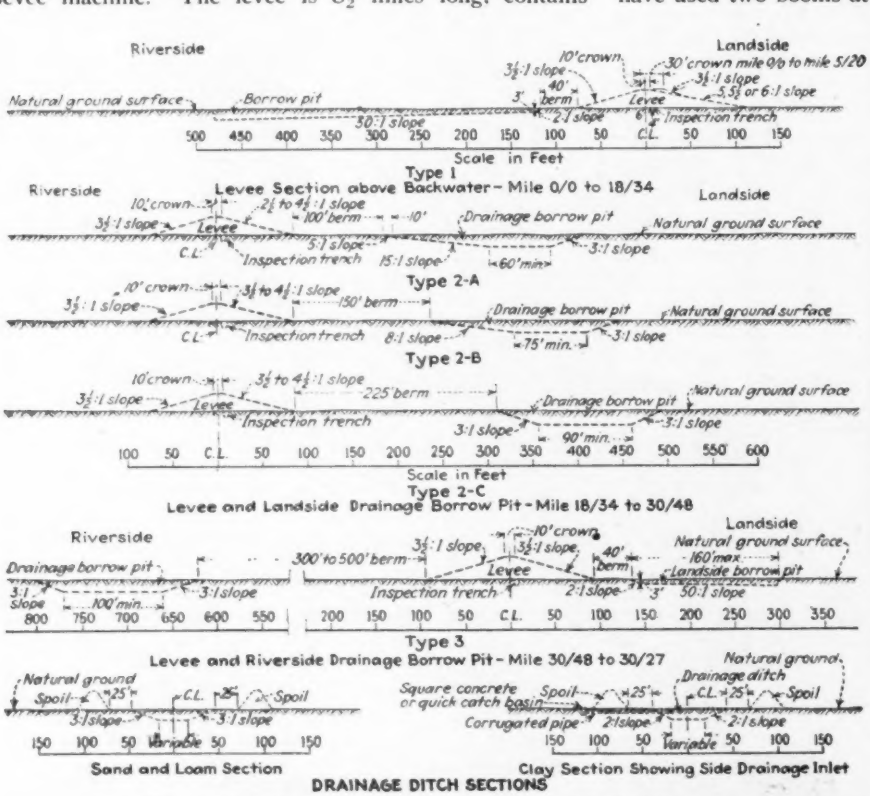


Fig. 2—Typical levee and ditch sections of New Madrid floodway

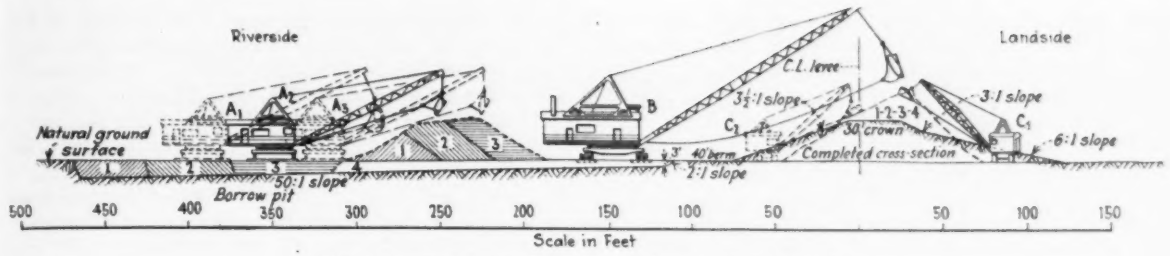


Fig. 3—Levee construction with draglines operated in series

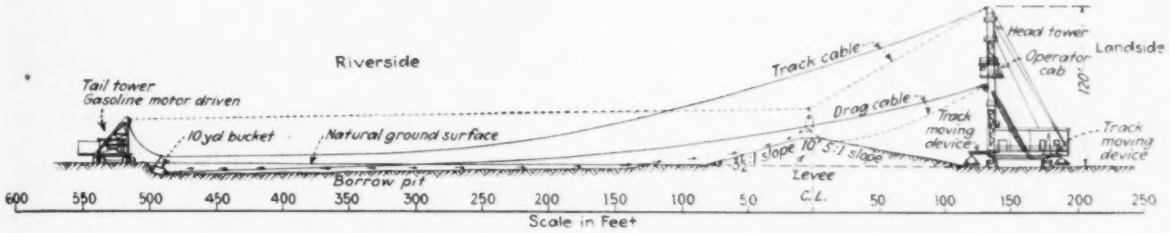


Fig. 4—Levee construction with electric tower excavator

railroad. The generating units are two direct-connected 400-hp. diesel engines. The transmission line to the machine is aluminum strand on a pole line of native timber.

With this type of excavator the bucket digs as it travels and dumps as it is picked up, so the principal factors in determining production are the traveling speed and length of haul, or distance between center of mass of pit and center of mass of fill. The best month's record made by this machine was on a stretch averaging 14 ft. high, on which the average haul was approximately 250 ft., and was 230,000 cu.yd.

This machine is new and radical in design, and considerable time has been lost in making adjustments and getting it into proper operating shape. At the present time on his highest levee the contractor has been meeting some difficulty in developing properly the use of the rehaul cable. His average production for the job to date has been about 160,000 cu.yd. per month.

The tower excavator has a high operating efficiency on any levee up to about 22 ft. net, which gives it great flexibility on long jobs where there is considerable variation in levee heights. It is well adapted to contracts of large size because of the low operating cost and because the high installation charge may be spread over a large yardage. Tower excavators are rarely suited to relatively small jobs because of high installation cost. The material from the pit must be obtained opposite the station under construction, so that it requires continuous pits on one side of the embankment. The pits cannot be as well cleaned out as with draglines or elevating graders, ridges being left between bucket runs.

Construction by Tractors and Wagons

On the 2,153,000-cu.yd. contract (4-C) of the J. C. Johnston Co. considerable experimental work was at first carried on with cableways. The first one installed consisted of two towers, one at each toe of the levee; the tower on the pit side was the lower. Suspended between the tops of these two towers was a track cable which carried a trolley. The tower on the pit side carried an inclined track, which passed over a hump in the center of the tower about 20 ft. above the ground and terminated in a flared apron on the levee side. On the pit side the inclined track descended to the ground, where it connected with ground track crossing the berm and pit at right angles to the levee.

A car of about 2-cu.yd. capacity was operated on the track, being pulled by cable and hoisting engine. It was loaded by a dragline in the pit and pulled over the hump in the tower, where it slide into the frame carried by the trolley. The car was then carried out over the track cable to the dumping point, where a trip on the cable released the bottom door. As the car slid back into the apron leading over the hump, the bottom was closed and automatically latched. The towers on track had no propelling mechanism but were to be pulled by tractors.

This outfit never operated successfully over a period of time, as it was too light. It placed altogether some 5,000 cu.yd. Efforts to operate the plant were finally abandoned, as well as plans to replace it with an improved machine of the same general design.

The contractor then placed on the job draglines, tractors and wagons, and at the same time erected another cableway machine. The head tower, about 75 ft. high and of light structural steel, sits on the river side of the levee. The tail tower serves as an anchorage for the track cable and is provided with a gasoline rehaul engine and a propelling engine. The operation of this cableway differs from that on contract 4-B in that the bucket is hauled up the track cable and is dumped free in the air.

The real work is done with tractors and wagons and trucks loaded by draglines. The wagons are of the crawler type (eight 8-cu.yd. and two 6-cu.yd.) and are pulled by 60-hp. tractors. There are five 1½-cu.yd. draglines with 40- to 50-ft. booms. Three of these are used with eight tractor wagons, and two 5-cu.yd. ten-wheel dump trucks called tructors, which are fitted with continuous tracks over the four rear wheels on each side. This is a steel track placed over the regular pneumatic tires and is used only when ground conditions will not permit normal truck operation. When weather conditions permit, a unit consisting of one dragline and four six-wheel dump trucks is used.

Each dragline will load about 1,200 cu.yd. per shift, borrowpit measurement. Under favorable ground conditions each 8-cu.yd. wagon will handle about 500 cu.yd. per shift, with an average haul of 400 ft. These con-

ditions, however, are not to be expected over a period of operating time. Generally speaking, on this job each 8-cu.yd. wagon averages about 15,000 cu.yd. per month, working double shift.

This contractor makes extensive use of bulldozers in building his levee. He builds the levee continuously, keeping a long slope ahead, and dumps along this slope, spreading the material with bulldozers to maintain a smooth run and to dress the levee out to section. In this way the levee and pit are abreast, and the haul is reduced to a minimum. Mr. Johnston has personal direction of the work. Fig. 5 illustrates the method. This type of equipment is extensively used on the Mississippi, particularly on long hauls and where pits are irregular. In dry weather and with dry pit conditions it is hard to find a more satisfactory method; efficiency falls off very rapidly in unfavorable weather and maintenance costs increase.

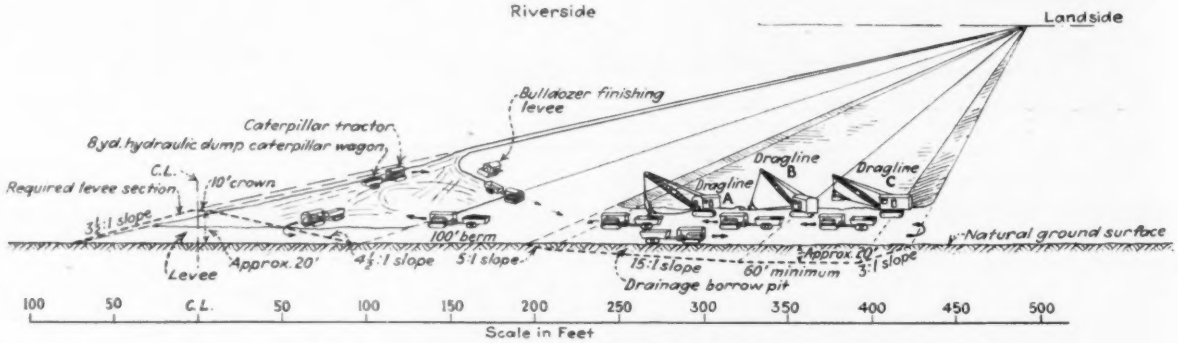


Fig. 5—Levee construction with dragline loaded tractor wagons

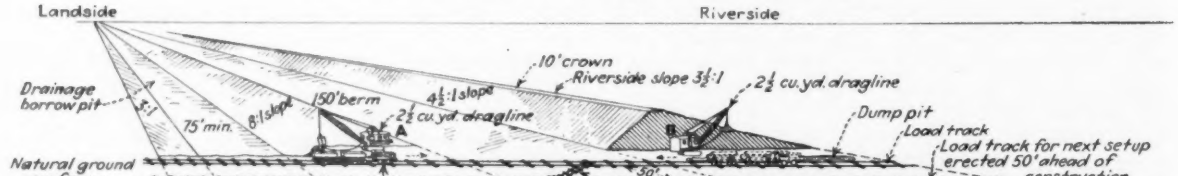


Fig. 6—Levee construction with draglines and railway haulage

Dragline and Railway Haulage

Contract 4-D, 2,153,000 cu.yd., James G. Yeats Co., contractor, is similar in design to 4-C. There is a wide variation of materials, from heavy clay to coarse sand. This contractor first experimented with a new method which he later discarded. The plan was to pull a 20-cu.yd. crawler wagon with the cable from a dragline passing over the end of the boom, which was supported near the end by a vertical strut. The wagon was to be loaded by another dragline. This method proved to be impracticable as the wagon could not be pulled up over the fill if the material was at all wet. The contractor then tried out a mud boat to be pulled in by the same method; this also proved unsuccessful. He then installed an industrial railroad outfit, illustrated by Fig. 6, which has proved very successful.

He uses a standard-gage track at right angles to the levee, which extends from the riverside toe of the levee to the landside edge of the pit. On the track two 12-cu.yd. air dump cars are drawn by a gasoline locomotive. The cars are loaded by a 2½-cu.yd. dragline, which excavates the pit to the required section. When loaded the cars are hauled across to the levee base and then dumped into a shallow pit. There another dragline picks up the material and builds the levee section. While working at one track location another line of track is being laid parallel to the first, about 50 ft. away, and the two are connected by a switch track. Then, immediately after one set-up is completed, the cars switch over onto the next track and work continues. Despite a considerable amount of mechanical trouble, this equipment has placed about 65,000 cu.yd. per month, working double shift. This is a very satisfactory and economical method on long-haul work. Mr. Yeats has given the work his personal supervision.

The contractor sublet about 1,300,000 cu.yd. of this work to the J. J. McCaughey Co. and the States Contracting Co., which have contract 4-A. This work is about equally divided between the upper and lower ends of the contract, Mr. Yeats having reserved the middle portion. So far, the subcontractor has confined his operation to the upper end. This work falls into two very distinct classes: about a mile, which runs 7,000 cu.yd. to the station; and about 3,000 ft., which runs 10,000 cu.yd. to the station. The first part is in sandy and light clay soil and lends itself very well to hauling equipment. This section is type 2-C. The top soil is clay, and the lower stratum is sand.

The contractor placed on this section a unit consisting of twenty four-up teams and 1½-cu.yd. dump wagons, eight 8-cu.yd. crawler wagons, two 6-cu.yd. crawler trucks, eight 60-hp. tractors, two power take-off elevating graders, one dragline and one gas shovel. Ordinarily he maintained in operation three loading units, about eighteen team wagons, six crawler wagons and one or two trucks. The team wagons took the top clay loaded with elevating grader and placed it in the base of the levee. This gave them the less tiring work. The sand from the bottom of the pit was then placed in the upper part of the levee with crawler wagons and trucks. This outfit, working single shift, places about 75,000 cu.yd. per month on an average haul of 400 ft.

The second section of this subcontract runs about

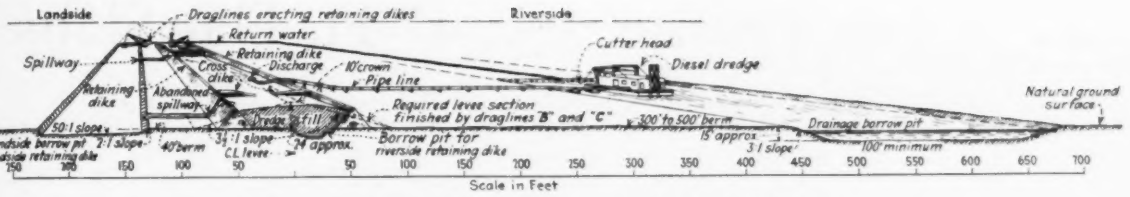


Fig. 7—Hydraulic-fill levee construction with pipe-line dredge

10,000 cu.yd. to the station and is in heavy gumbo. Borrowpit limitations in the standard pit provided on the land side were such that to secure sufficient material it would be necessary to go out an excessive distance. To reduce the average haul the contractor obtained a pit on the river side, conforming to standard riverside borrowpit specifications for type 1. By doing this the average haul is reduced to about 400 ft., when this pit is used in conjunction with the landside pit.

On this section the contractor is using a walking dragline with 135-ft. boom, 5½-cu.yd. bucket, powered with a 300-hp. diesel engine, and a steam dragline converted from a shovel into a 150-ft. boom dragline carrying a 6-cu.yd. bucket. The general plan of operation is for one machine to cast over and the other to build the levee, a process similar to that used on 4-A. In this case, however, the machines travel up one side using that pit, then down the other using the second pit. Generally, the walking dragline, because of its greater flexibility, finishes the levee. The capacity of this outfit is, of course, the capacity of the finishing machine, or about 125,000 cu.yd. per month.

Hydraulic Dredge Construction

Contract 4-F, 1,760,000 cu.yd., is held by Wilbanks & Pierce, Inc. The levee and ditch section is type 3. It will be noted that the berm varies from 300 to 500 ft., giving an average haul of about 600 ft.

It was also specified that timber should not be removed from the berm between the ditch and the levee, except in occasional cross-cuts at right angles to the levee. The purpose of this was to protect the levee from excessive scour. The work is located at the lower end of the backwater area of the upper St. Francis levee district. This made it appear likely that the working season for dry-land equipment might be very short. This job, therefore, appeared to be ideal for dredging equipment. The contractors are experienced levee builders with the dredging method.

The method they are using is illustrated by Fig. 7 The first operation is to construct the retaining dikes of sufficient height and span to contain the hydraulic fill. Where they are constructed loosely with draglines, of clay or silty materials, they must be built about 25 per cent higher than desired, to allow for shrinkage when they come in contact with the dredged material.

The landslide dike was built from material in a landside borrowpit of standard riverside pit specifications. This was contemplated in the original plans and the right-of-way provided. The riverside dike was constructed by excavating from the levee base between the dikes. At 750-ft. intervals cross-dikes are constructed, and close to these cross-dikes outlets are provided for the water from the dredge fill. The contractor is not permitted to pool water between the dikes but must let it flow out freely at the spillways.

The dredge is a diesel engine operated, 12-in. cutterhead dredge. It came in at a fairly high stage, permitting it to float up St. John's Bayou to the lower end of the job, where it locked itself into the canal and started pumping into the levee. The pipe line is about 1,000 ft. long, and the maximum lift is about 35 ft. In order to reduce the average pumping lift, the contractor has placed most of the fill in two lifts.

Where no pooling is permitted it is desirable to have material that readily deposits in the fill. The most satisfactory materials are coarse sand, because it is heavy and settles rapidly, and clay, because it is balled up by the cutterhead and does not go into solution but comes out of the discharge pipe in balls, which immediately build out the fill. In building up the fill the pipe is first carried along each retaining levee and then down the center; in this way the central part of the fill is carried several feet higher than the retaining dikes.

The 12-in. dredge has been pumping about 50,000 cu.yd. per month, fill measurement. Recently the production rate has increased to 65,000 cu.yd., as the percentage of silt has decreased and the percentage of clay increased. As this rate is not sufficient to complete the job on time, the contractor has arranged with Woods Brothers Construction Co., of Lincoln, Neb., to put a 15-in. electric dredge on the job.

After the material, which has been pumped into the fill, has an opportunity to dry out, the draglines that have constructed the retaining dikes will go over the fill shaping up the levee section. It is expected that it may be necessary to carry drainage ditches in the fill parallel to the retaining dikes to insure the drainage of the pumped material to the point where the fill may be safely carried to grade and section. This type of equipment is most successfully used on long-haul work in heavy clay or sand where other types of equipment encounter difficulty because of poor drainage or long haul. In soils carrying a high percentage of silt this equipment is not satisfactory. Ample power is a necessity, particularly in heavy clay.

Engineering Direction

This work has been designed and carried out under the direction of Lieut. Col. F. B. Wilby, district engineer, Memphis Engineer District, and reviewed and approved by Brig. Gen. T. H. Jackson, president of the Mississippi River commission, and by the chief of engineers, U. S. Army. The construction plans were prepared and construction was supervised by the writer, T. T. Knappen, area engineer, First Field Area, Memphis Engineer District, under the direction of the district engineer. The area engineer's assistants in the design and construction of this work are: G. L. Perry, associate engineer, principal assistant; G. A. Amberg, assistant engineer, drainage, bridges, and general design; W. A. Steele, assistant engineer, levees; J. N. Van Frank, assistant engineer, rights-of-way, surveys and drafting; E. F. Tippetts, inspector, in charge of levee inspection; and Leonard G. Hogue, inspector, in charge of drainage inspection.

Concrete Trusses and 47-Ft. Flat Slabs in New Seattle Viaduct

Structure solves major traffic problem—Slab design aids formwork and placement —Concrete-truss economy proved by bids

By CLARK H. ELDRIDGE
Bridge Engineer, Office of City Engineer, Seattle, Wash.

THE West Garfield St. bridge, recently completed in Seattle at a cost of about $750,000, constitutes a major development in the city's traffic system and contains some distinguishing features of reinforced-concrete design, including heavy flat-slab construction on spans up to a maximum of 47 ft. and reinforced-concrete trusses 60 ft. long. The structure was built to provide direct traffic access to a choice residential district which had been handicapped by an indirect timber-trestle approach on steep grades. Securing of proper clearances for this 3,000-ft. structure over industrial areas and the high connection to the Bluff district necessitated a maximum height of 107 ft. above tidewater.

Position and Use—Separated from the rest of the city by an industrial zone of low elevation and extensive railroad yards, the choice Magnolia Bluff residential district has been hampered in development by lack of direct and adequate traffic connection to the business district. The old timber-trestle approach by a circuitous route tended to discourage traffic. In addition, the Smith Cove terminals of the port of Seattle in the intervening industrial area did not have satisfactory or permanent approaches. The present project, initiated in 1925 and completed with formal opening on Dec. 6, 1930, provides the necessary traffic solution for both developments and constitutes a major improvement in the city's street and traffic system.

Proper clearances above the railroad trackage and the established elevation of the upper passenger floors at the dock structures practically predetermined bridge elevation at the east approach. At the west end it was essential to provide a connection to the existing street system on the high ground of the Bluff district, which required a grade of 6.32 per cent and a 500-ft. radius curve. This western section of the bridge traverses low mud flats flooded at high tide and constitutes the point of maximum height, which is 107 ft. above high tide. The structure is 3,010 ft. long between abutments, and 286 ft. of the east approach consists of retained fill with concrete pavement. The minimum width consists of a 36-ft. roadway and two 6-ft. walks, and this roadway width is increased in front of the dock property to 60 ft. 8 in. The lower level of the dock property is served by a ramp which descends from the middle of the roadway. The west approach required the grading and paving of approximately 2,000 ft. of street to furnish the necessary connection. General features of the structure are shown in Fig. 1.

With the exception of a crossing over railroad property near the east end, which is carried by plate girders, the structure is entirely of reinforced concrete. One-way slab design was used throughout, except for 709 ft. of truss spans at the high portion near the west end.

Loads and Concrete—The design specifications were based on a live load of two 20-ton trucks with a 100 per cent impact allowance on the rear axle of one truck. A concrete mix of approximately 1 : 2 : 3, developing 3,000 lb. per sq.in. in 28 days, was specified, and a working stress of 1,200 lb. per sq.in. was used in design. Test cylinders taken during the progress of the work showed strengths ranging from 2,740 to 5,489 lb. per sq.in., grouped according to strength as follows:

4	cylinders broke below 3,000 lb. per sq.in.
15	cylinders broke between 3,000 and 3,500 lb. per sq.in.
28	cylinders broke between 3,500 and 4,000 lb. per sq.in.
16	cylinders broke between 4,000 and 4,500 lb. per sq.in.
10	cylinders broke above 4,500 lb. per sq.in.

The 73 cylinders averged 3,867 lb. per sq.in.

Slab Design—The design for the one-way slab section of the bridge is the same as has been used in similar bridges built in Seattle during recent years. It consists of bents of two or more columns capped with wide shallow beams. A heavy slab, reinforced primarily in one direction only and thickened for negative moment at the supports, spans directly from bent to bent. There are no longitudinal beams, stringers or girders in the roadway portion, the slab itself with its wide effective breadth constituting the sole structural element. Among the advantages that result from this type of construction are: (1) formwork is of maximum simplicity; (2) reinforcing bars are large and uncrowded; (3) concrete can be placed with ease, although stiffer and of lower water content than would be possible with ordinary beam and girder framing; (4) concrete can be more thoroughly cured; (5) a construction providing maximum clearances

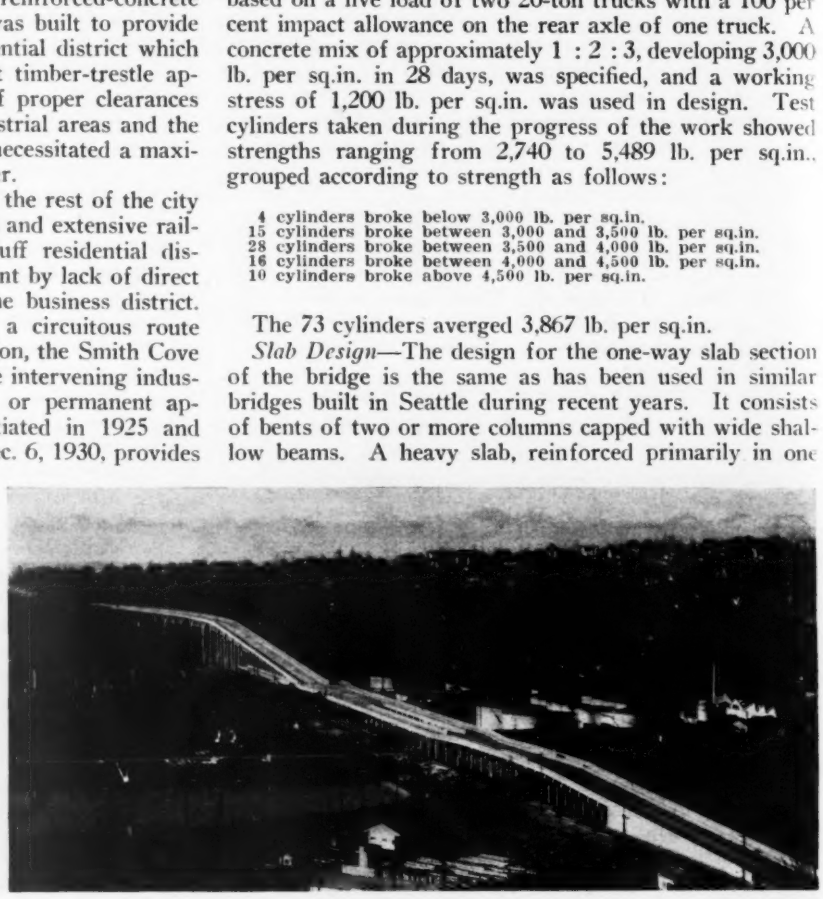


Fig. 1—West Garfield St. bridge, looking west toward Magnolia Bluff

or shallowest depth of deck is obtained; (6) the distribution of heavy concentrated wheel-loads is accomplished very effectively; and (7) the cost appears to be consistently lower than with other forms of reinforced-concrete framing.

The length of the structure warranted a careful study to determine economic spans and bent spacing. The result was the adoption of a standard unit consisting of four full continuous spans, with the two outer ones 32 ft. and the two inner ones 36 ft., center to center of bents. At both ends of this four-span unit the deck slab cantilevered 5 ft. beyond the center of the supporting bent, terminating in the joint which provided support for the 18-ft. suspended slab between adjacent units. This suspended slab provided for expansion and contraction in the deck as a whole and also provided a certain adjustment and relief of stress should there be any slight unequal settlement in adjoining bents. This combination of spans, analyzed as a continuous structure, gave a constant slab depth of 12 in.

It was considered more advantageous to keep the slab thickness constant than to maintain a uniform bent spacing. Deflection beyond the edge of the supporting cap beams, which were 5 ft. wide, being impossible, the span length used in the calculations was the clear span only. Garfield St. is crossed at frequent intervals by switching tracks and intersecting streets, and in order to provide necessary horizontal clearances the typical span layout had to be modified somewhat, but it was possible to space the bents to maintain a 12-in. slab depth.

The expansion joint used was originated by the Seattle bridge department and has been used on several recent bridges with entire satisfaction. It was described and illustrated in the author's description of the Second Ave. extension, *Engineering News-Record*, Dec. 18, 1930, p. 981. Essentially, it consists of 3½-in. steel dowels with one end embedded in the concrete and the other incased in a steel cap. Spaced at 6-ft. centers these dowels transfer the load across the joint and permit expansion.

Fig. 3—Trussed section of viaduct

The four-span construction as described was continued until the height of the viaduct rendered it uneconomical. At this point the span layout was changed to three-span units (42, 47 and 42 ft.) with 6-ft. cantilevers, 6-ft. cap beams and a 25-ft. suspended slab. The slab depth for these units was constant at 14½ in.

Reinforcing steel for these roadway slabs was designed according to standard practice for one-way construction. For the 47-ft. c. to c. span the bars consist of two ⅞-in. round and one 1-in. round in a 10½-in. width of 14½-in. slab, or at a spacing of 3½ in. Over the supports at the ends of this slab the reinforcing consists of one ⅞-, 1- and 1¼-in. round bar in a 10½-in. width.

Truss Design—For the truss portion alternate designs were prepared, and alternate bids were invited on two constructions; one used a concrete deck, concrete trusses and concrete columns and footings; the other used a concrete deck, structural-steel floor beams, steel trusses and columns, and concrete footings. This section was 709 ft. long and 71 to 107 ft. high.

Estimates indicated that despite the high unit cost of the concrete in the truss members themselves the concrete construction was the more economical in first cost, as well as more economical in subsequent maintenance expense. The bids verified this conclusion. The bid for the steel-truss portion totaled $164,500.79, while the bid on the concrete alternate amounted to $139,624.99, a difference of about 18 per cent.

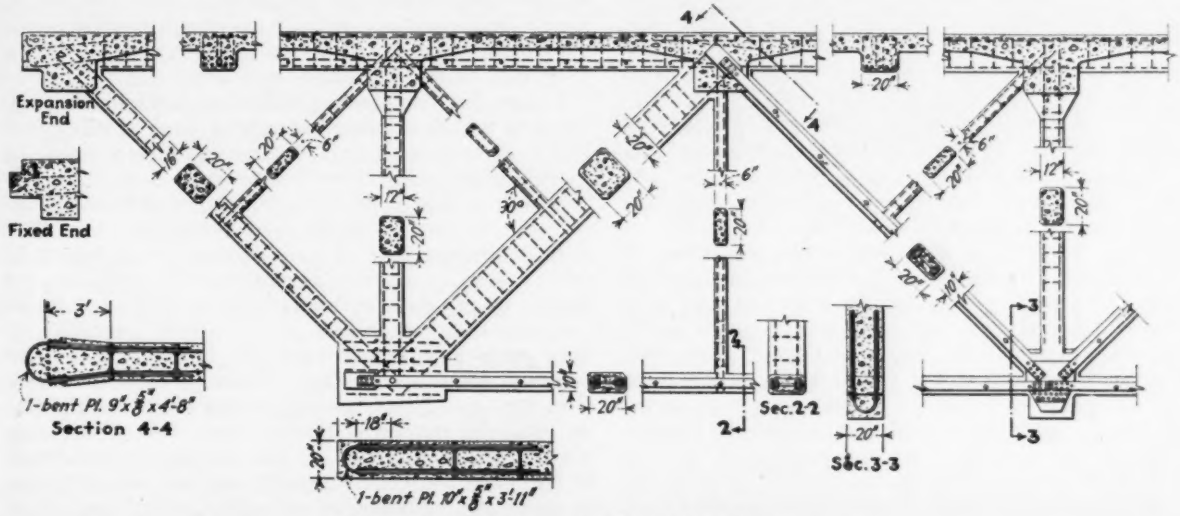


Fig. 2—Member make-up of 60-ft. reinforced-concrete truss

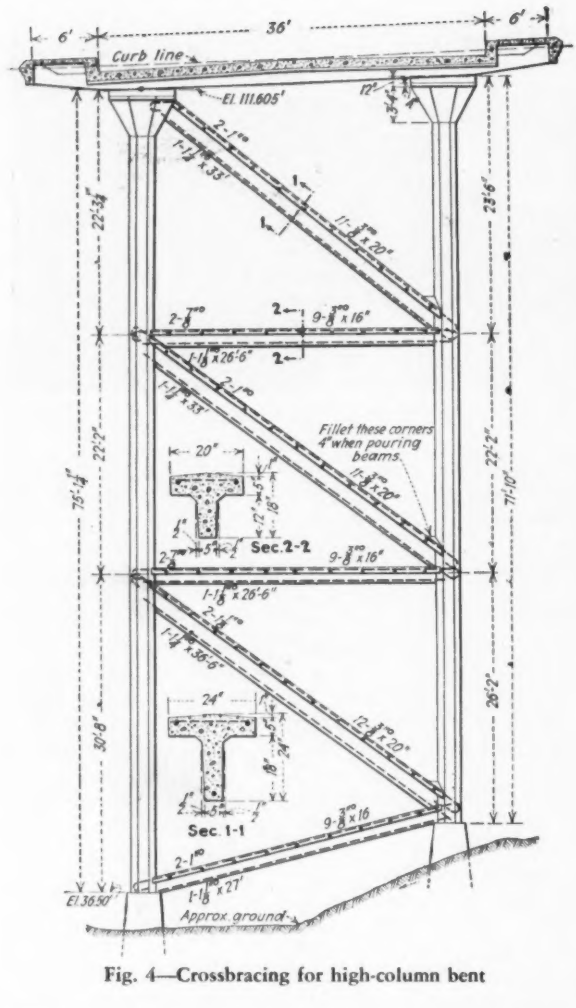


Fig. 4—Crossbracing for high-column bent

This truss portion was complicated by an alignment involving a roadway on a 500-ft. radius curve with a 6.32 per cent grade and a superelevation of 1.6 ft. in the 36-ft. width. The condition necessitated fairly short spans, and, after an economic analysis, 60 ft. was adopted for the concrete trusses and 70 ft. for the steel.

The design of the concrete trusses is similar to that used on the Admiral Way Bridge, built in 1927 and described briefly in *Engineering News-Record*, March 15, 1928, p. 440. The layout provides for 60-ft. truss spans with 15-ft. cantilever panels at both ends. A 13-ft. suspended slab spans between the cantilever ends of adjacent trusses. Dead-load moments, developed over the supports by the cantilever ends, and suspended slabs materially reduce dead load stresses in the truss chords at midspan, leaving chiefly live load to be provided for.

Principal features of the truss design are shown in Fig. 2. The lower chords and the tension diagonals are the most distinctive features of the truss and consist of flat structural-steel bars connecting with the ends of the compression members by means of curved plates that loop around and engage the concrete. These flat bars of the tension members are wrapped with wire mesh, and concrete is poured around the assembly to provide the desired size of members. It is pertinent to remark that a recent examination of the trusses built on the Admiral Way Bridge shows them to be in excellent condition without cracks in the concrete.

Concrete Placing—Both truss and deck, constituting the portion of the structure above the top of the supporting columns, were concreted in one operation. Less difficulty was encountered in these concrete operations than would have been anticipated from the experience with the Admiral Way job. A great improvement was effected by the omission of certain structural-steel bars and mesh wrapping from the top chords in the present structure. Concrete in the inclined web members was thoroughly rodded and tamped, and the forms were hammered, with the result that almost perfect placement was obtained. To eliminate the stresses that might develop in the fresh concrete as a result of unequal settlement of the supports, the trusses were carried entirely by wooden forms until the concrete had developed its full design strength. Not until that time were they grouted in to their permanent column supports and bearings.

The total cost of the improvement will be about $750,000 and is divided between the railroad companies, the port of Seattle, the general fund and an assessment district covering Magnolia Bluff.

The bridge was designed in the office of the city engineer by the late A. W. Munster, consulting engineer, with the writer in direct charge of design. Construction was executed by J. M. Clapp, engineer and contractor, under the supervision of the city engineer's forces.

Railway Consolidation for Australia

WITH THE 26,000-mile railway system of Australia owned and operated as six distinct systems by five state governments and the federal or commonwealth government, and with all of these roads suffering from continued and increasing losses of revenue, a consolidation of all the lines into one national system has been recommended on economic grounds by George A. Gahan, commonwealth railway commissioner. While federation of the states, as effected some years ago, has resulted in uniform mail and telegraph service, the railroads remain as separate systems, with no common policy to facilitate operation, effect a uniform gage, establish uniform rates, eliminate frontier boundaries or reduce operating expenses. After referring to the difficulties involved, Mr. Gahan says, "Never was it more necessary that the governments of the commonwealth and the states should subordinate local considerations for the national good and make a united effort to eliminate the economic waste which now occurs, owing to the diversified system of railway administration."

For the five years ending with June, 1930, the financial losses of all the railways aggregated some $155,000,000. While investigations and reports have been made by special commissions from time to time, these have produced no results, since these commissions have had no authority to put their recommendations into effect. But in the meantime road and air transport have been subsidized, to the further disadvantage of the railways. A change to private ownership is considered out of the question, since purchasers would find it necessary to close many lines that do not pay, reduce services and establish new rates in order to make some profit. Such conditions would have an unfavorable effect upon industry and the country's development. As a first step toward consolidation Mr. Gahan proposes a conference of the state and commonwealth railway commissioners to study the situation on a national basis and make uniform recommendations to their governments.

Driving and Lining a 6-Ft. Tunnel in Gravel

Combination panel and rib-supported wood-pipe stave forms used with hand-shoveled concrete

By W. B. McMILLAN

Construction Engineer for Olympic Forest Products Co., Port Angeles, Wash.

TUNNEL-DRIVING in fine gravel and hand-shoveling methods for placing concrete lining were features of construction on the recently completed 8-mile conduit to bring water to the pulp and paper industry at Port Angeles, Wash. The time limit set for completing the project, because of the concurrent building of a large chemical pulp plant, imposed a rigid tunnel-driving and lining schedule for the 1½ miles of 6-ft. bore. Decision to place the concrete lining by hand was made primarily because of the advantage of being able to speed up this part of the work quickly by putting on additional lining crews and using inexpensive and easily made forms built on the job.

The new water supply for Port Angeles and its several pulp and paper industries is taken from the Elwha River a few miles above its discharge into Puget Sound. The conduit capacity as built is 65 million gallons per day (65 m.g.d.), but the upper works and tunnel sections were designed for an ultimate supply of 100 m.g.d. From the intake in the river the first 900 ft. of the conduit is tunnel, followed by about 2,000 ft. of open canal. The next section consists of about a mile of 72-in. wood-stave pipe and the major tunnel, which is about 1½ miles long. From the lower end of this tunnel a 57-in. concrete pipe conveys the water along the beach to the distribution system.

The 900 ft. of intake tunnel was driven through rock of variable formation but presented no unusual difficulties. Timbering was required throughout most of the distance and concrete lining was placed to provide against disintegration and erosion. Although the first 64 ft. from the lower portal was driven through wet gravel and boulders and required 26 days' driving time, progress on the rest of the work averaged 10.1 ft. per day, working two shifts.

Difficulties in driving the 1½-mile length of tunnel resulted from encountering formations that were not apparent from surface indications. It was expected that driving would be through cemented gravel for most of the distance, but the material actually encountered for more than 1 mile was fine sand interspersed and stratified with loose pea gravel. The remaining one-third of the distance was through cemented gravel which made driving comparatively easy using light jackhammers and gads. The cemented gravel could be excavated 4 to 6 ft. ahead of the timbering, and the average progress was about 15 ft. per day per heading for three shifts. A sustained progress of 22½ ft. per day in one heading was the maximum.

Particular difficulty was experienced in driving through the loose gravel. Square timber sets shown in Fig. 1 were required throughout the work, with driven lagging in the roof and generally on the sides down to the floor. To keep the gravel from running, it was necessary at times to breastboard and stuff the cracks with excelsior. Driving in the fine sand formation was facilitated by using a core in the heading to hold the face. The sand was damp and stood up well to allow fair driving speed to be made. Fortunately, a layer of cemented gravel extended almost horizontally at from 10 to 15 ft. about the tunnel roof, which prevented heavy caving and eased the weight on the timbers to the extent that no difficulty was experienced in holding the ground. The average progress through the loose formations was about 11 ft. per heading per day, with a sustained maximum of 20 ft. per day for three shifts.

After driving, the square sets were sheathed and backfilled with sand to prevent using an excess of concrete

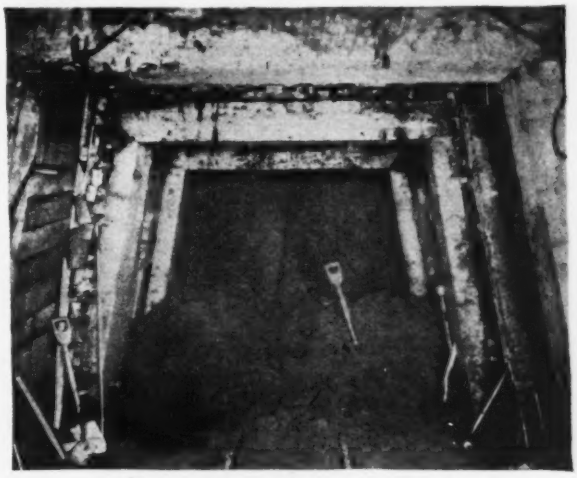


Fig. 1—Tunnel-driving in fine sand
Note driven lagging on top and walls.

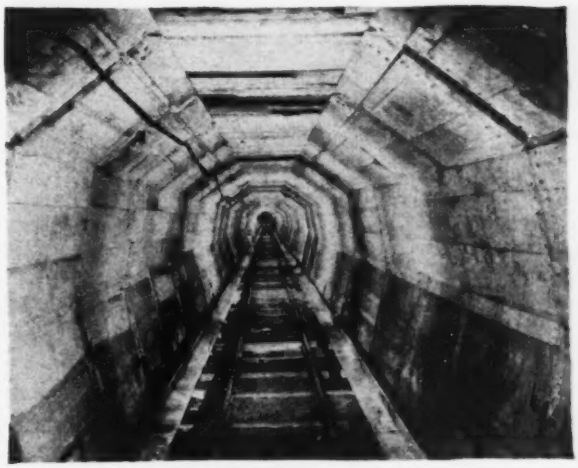


Fig. 2—Timbering sheathed for concreting
Timber backfilled with sand and left in place. Base board for forms set.

lining. This backfill was packed solid and wedged in the roof with timber blocking. This timber lining was left in place, and the permanent 6-in. concrete lining was poured against the sheathing as a back form.

The method to be used in placing the concrete lining was given considerable study because of the time limit imposed on the work. Pneumatic placement in a small tunnel is difficult without causing considerable interference with the driving schedule and is necessarily limited by available equipment. Hand-placing methods allow as many placing crews as necessary to meet the schedule, and these means were adopted.

The timber side-panel forms in 8-ft. lengths extended to a height of about 2 ft. 6 in., as shown in Fig. 4. The top piece of this side form was a steel channel upon which the top-form ribs of semicircular bent channels were placed at 4 ft. on centers. These ribs were bent to a 2 ft. 9½-in. radius and were wedged to the roof timbers to hold against the buoyant effect of the concrete.

Lining precedure consisted of dumping the concrete brought into the tunnel in ore cars onto steel mucking plates, which were bent to fit the rails so that cars could be moved over them without interference. The concrete then was shoveled behind the side forms and thoroughly tamped and worked with steel bars. When the concrete reached the top of the side forms, wood-pipe staves 8 ft. long cut to a curvature of 72 in. were dropped behind the steel ribs one at a time, and the shoveling was continued. By raising the stave lagging piece by piece, concrete placing was continued to the crown. At this point curved steel plates with beveled edges in 2-ft. sections were used to close the last 20 in. at the top, and the lining was finished. The closure arrangement with these steel plates greatly facilitated the placing of concrete in the crown where the reinforcing steel made overhead shoveling difficult.

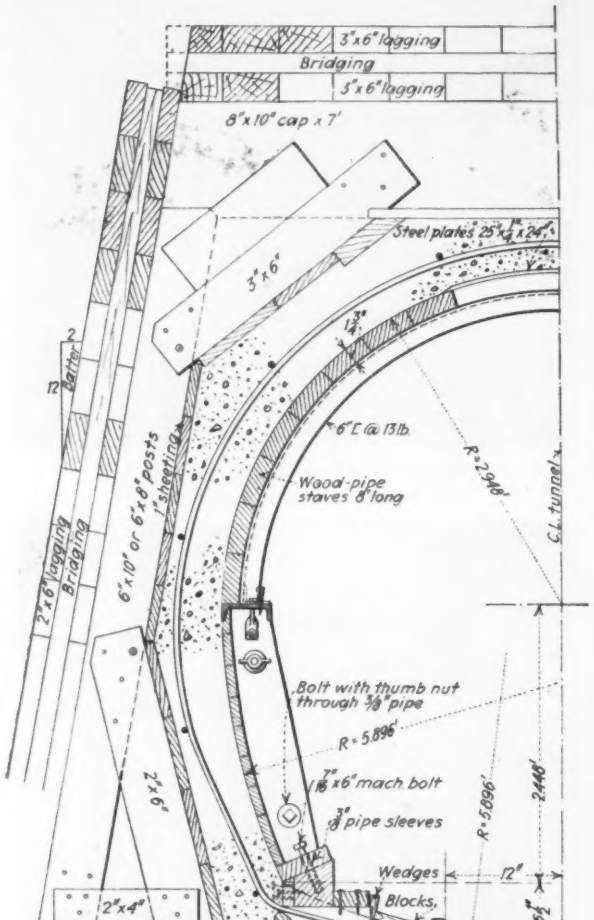


Fig. 3—Section of timbering used in sand and forms designed for hand shoveling

Forms struck by removing wedges and blocks at lower corners. Invert is poured later

Fig. 4—Forms for hand-shoveled mining

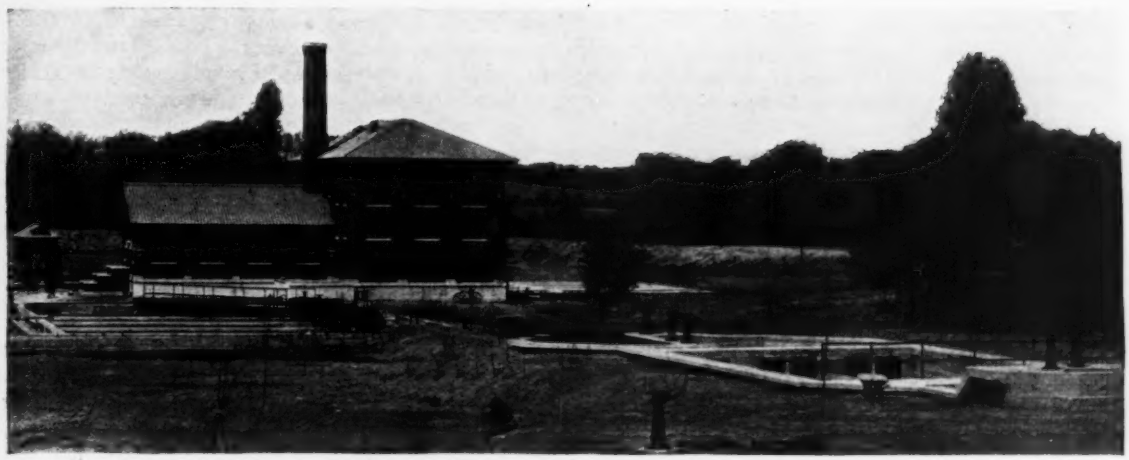
Concrete dumped on steel mucking plates. Top forms are wood-pipe staves behind channel ribs.

Forms were struck by removing the wedge blocks supporting the side panels. This permitted the weight of the forms to assist in the work of stripping. The assembly of supporting blocks appears complicated, but the design proved effective for both erecting and stripping. The sequence of form-setting consisted of: (1) realigning and setting the track to grade; (2) setting the baseboards, which were notched for the reinforcing bars; (3) placing the side panels and upper form ribs. The baseboards and steel were set considerably in advance, which permitted the actual forms to be set very quickly.

The invert was poured last with the rails elevated on bolsters spanning between the poured walls. Progress in lining the sides and roof averaged 114 ft. per day, with a maximum of 208 ft. The sustained maximum average was 135 ft. per day, and 256 ft. of tunnel forms was used. Pouring of the floor averaged 285 ft. per day, and the maximum reached was 375 ft. per day per crew.

The concrete contained 1.5 bbl. of cement per cubic yard, with a mix of sand and gravel designed to provide a 2,800-lb. concrete at 28 days. It was premixed in Port Angeles and transported by truck with a maximum haul of about 7½ miles. No great difficulty was experienced with this method, the several handlings in and out of hoppers and cars serving to preserve fair flowability of the mix. The introduction of a creosote water-proofing fluid appeared to assist in improving workability, particularly in facilitating dumping from the trucks and cars. Tests showed a 94 per cent strength after the 7½-mile haul at seven days and practically 100 per cent strength at 28 days in comparison with test specimens not subjected to the 7½-mile truck haul.

The work was done under a bond issue of $800,000 voted by the city of Port Angeles. To insure the delivery of water before the completion of its new pulp mill, the Olympic Forest Products Co. entered into a contract with the city for the construction of the conduit under regular bidding regulations with the city bonds accepted as payment. The tunnel excavation was let out on labor contract, the company furnishing the equipment. The concrete lining was also done by the company in order to have full control of the work and to insure its completion according to schedule.



Springfield activated-sludge plant treats completely 30 per cent of sewage

Total flow given partial treatment in preliminary settling tanks. Screens and grit chamber at right, preliminary settling tanks at left and aeration tanks to right of laboratory building.

Water and Sewage Problems of Four Illinois Cities

Secondary aeration prior to water filtration in Urbana iron-removal plant—Decatur solves sewage odor problem—New activated-sludge plant at Springfield

INDICATIVE of the originality and ingenuity required of sanitary engineers and plant operators, the diversity of problems presented by the water- and sewage-treatment plants of four Illinois cities is instructive and interesting. At the iron-removal plant of the Champaign & Urbana Water Co., supplying the twin city of Champaign-Urbana, secondary aeration is employed prior to filtration, and heavy chlorination of the wash-water prevents micro-organism growth in the sand beds. Sewage-treatment processes at Decatur have been developed to the point where they completely solve the unusually difficult odor problem, caused by a high starch-waste content in the sewage. Aeration of the settled sewage has greatly increased the capacity of the trickling filters.

Downstream from Decatur is Springfield's water-supply intake. Studies of the effects of Decatur's sewage-plant effluent on Springfield's water supply have given valuable information as to the workings of natural purification. Springfield's spent water is treated by the activated-sludge process in a plant designed to permit comparisons of the performances of various types of equipment and methods of operation.

A number of the water- and sewage-treatment problems at these four cities are set forth in some detail in what follows, based on notes taken during a recent visit to the various communities.

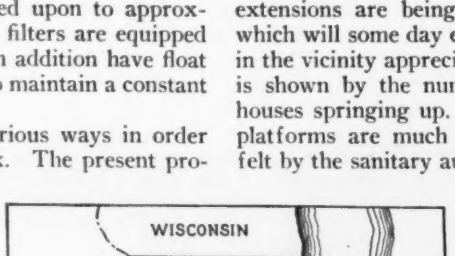
A water high in iron content is obtained from the moderately deep wells of the Champaign & Urbana Water Co. Aeration is relied upon to coagulate the iron compounds so that they can be successfully removed by sedimentation and filtration before the water is pumped into the main supplying the adjoining cities. The initial aeration is accomplished by allowing the water a free fall through the air for several feet as it enters the sedimentation basin. A horizontal 24-in. cast-iron pipe supported above the inlet end of the sedimentation basin and having a number of holes drilled in the top forms the inlet to the basin. The water flows out of these holes and falls on a series of shallow staggered overflow troughs several feet below, from the last of which it drops into the basin. The pronounced red color of the water flowing through the basin gives evidence of the flocculent iron hydrate produced by the aeration.

Filtration through rapid filters follows the sedimentation process. Before passing through the sand, however, the water is subjected to secondary aeration, which further oxidizes any iron salts still in solution. This secondary aeration is effected by an arrangement of the filter influent piping whereby the incoming water is again allowed a free drop before being applied to the filter bed. The pipe connecting with the sedimentation basin is brought up vertically through the center of the sand bed and terminates in an open end a few feet lower than the basin level. The operating level of the water on the filter is 3 or 4 ft. more below the end of the influent pipe. As the valve in the influent line is opened, the water from the basin flows out of the open end of the pipe and has a fall of about 4 ft. to the level of the filter. This arrangement was originally designed to assure a constant rate of flow from the basin to the filter.

Except at two filters recently added to the plant, there

is no automatic control of the filtration rate. Manual operation of the filter valves is relied upon to approximate a uniform rate. The two new filters are equipped with automatic rate controllers and in addition have float valves installed on the influent lines to maintain a constant level of water on the bed.

The water has been treated in various ways in order to overcome troubles with crenothrix. The present procedure is to apply chlorine at two points during filtration—at the suction of the raw water pump and to the effluent from the filters. About 12 lb. of chlorine is applied per million gallons of water treated. The dose between the influent and effluent is so proportioned that there is about 0.2 p.p.m. residual chlorine in the effluent. When enough chlorine has been put into the effluent to secure this result the remainder goes to the influent. When the filters are washed, the full capacity of the chlorinator is turned loose into the wash water. The strength of the dose is not known, but it is very great, and free chlorine gas escapes into the filter house.



Where water and sludge problems were investigated

It was at this plant that use was made for some years of an auxiliary grid of wash-water piping, jets from which agitated the top surface of the sand beds during the washing process. This auxiliary system, similar to that experimented with in Oakland, Calif., in 1907, has since been abandoned at Urbana and the grid has been removed. But a similar system is being further developed at the Chicago experimental filter plant and gives promise of success.

Trickling Filter Studies

Much study has been given to the performance of the Urbana sewage-treatment plant. The treatment consists of sedimentation and sludge digestion in Imhoff tanks followed by passage through trickling filters. Experiments have recently been conducted to determine the relative purifying performances of successive layers of stone in the trickling filters. These experiments indicate that at Urbana purification proceeds at a fairly uniform rate as the liquid trickles down into the bed, but that there is a sharp reduction in purification effect after a depth of 6 or 7 ft. has been reached.

Decatur's Reservoir Used for Recreation

The north fork of the Sangamon River supplies water to the city of Decatur. The hardness of the supply, as is the case with all surface supplies in this region, is quite high. Treatment consists of the application of lime and aluminum sulphate as softening and coagulating chemicals, sedimentation and filtration, with carbonation as an intermediate step to prevent after-precipitation of calcium carbonate.

To provide for periods of low river flow, a concrete dam at the water-works impounds a reservoir 12 miles long and half a mile wide, which makes possible an average draft of 42 m.g.d. Named Lake Decatur, this reservoir adds greatly to the attractiveness of a region otherwise quite devoid of bodies of water. Each year extensions are being made to a road along the shore which will some day encircle the lake. That the residents in the vicinity appreciate the value of such a development is shown by the number of cottage colonies and clubhouses springing up. Outboard motorboats and bathing platforms are much in evidence. No great concern is felt by the sanitary authorities over the possibility of pollution arising from this activity, because of the great size of the lake in relation to the possible concentration of population drawn from the surrounding neighborhoods.

The treatment of Decatur's sewage has long presented a problem well worth studying by the country's sanitary engineers. Of a total dry-weather flow of about 10 m.g.d., about 40 per cent is contributed by a corn-starch plant, one of the city's largest industries, the waste products of which are very high in organic content and of high temperature. Because of this large volume of industrial waste, the total sewage to be treated has a population equivalent of 300,000, although the actual population of the city is only 50,000. The starch waste contains considerable quantities of sulphur dioxide which, under the action of the domestic sewage, decomposes to form hydrogen sulphide. This decomposition is hastened by the high temperature.

The history of the development of a satisfactory method of treating Decatur's sewage is long and interesting. During the decade from the time the first experimental plant was built and operated by Pearse and Greeley (1914) until the treatment plant was placed in operation (1924) many schemes were investigated. Some were the orthodox processes used for years in other places and under other conditions, and at least one had behind it little more than commercial hopes. This was the electrolytic treatment project, tried under contract in a working-scale plant that was the subject of much controversy. The plant finally to emerge from the long investigation consisted of a grit chamber, Imhoff tanks and trickling filters. Recently a pre-aeration process has been added to aerate the Imhoff tank effluent before it goes to the trickling filters. This last expedient results in greatly increasing the filter capacity, making costly enlargements unnecessary for some years to come. The aeration takes place in a tank similar to the spiral-flow aeration tanks used in activated-sludge plants, but the period of aeration is much shorter.

Odor Problem Solved

During the early months of the operation of the Imhoff tank the odor problem became acute. According to W. D. Hatfield, superintendent of the plant, the concentration of hydrogen sulphide in the air in the neighborhood was so high that stained shingles were discolored on houses a mile away. To relieve the condition the grit chamber, the open channels conveying the sewage, and the Imhoff tank gas vents, were all covered with concrete slabs. The

hydrogen sulphide liberated from the sewage and the gases produced by the sludge digestion were collected in pipes and burned. At the present time the gas-burning appliances in the laboratory utilize this gas, which also furnishes heat for the laboratory building in winter. The excess over these quantities is burned to waste. The odor problem has thus been solved. There is now no offensive odor in the neighborhood. In fact the esthetic value of the atmospheric directly at the plant is much higher than that at many other places not faced with such difficulties.

A valuable lesson has recently been learned in regard to the proper size of pipes for collection of gas in sewage plants. When gas collection was first used in Decatur, 1-in. pipes were installed to convey the gas from each tank to the main collector. Although these lines were large enough to carry the gas during the very cold winter that followed, the moisture with which the gas is saturated froze on the inside of the pipe to such an extent that some of the lines became completely plugged. The small lines were then removed and replaced by 2-in. pipes, and the trouble was eliminated; frost formed on the inside of the larger pipes to a limited thickness, after which the insulating effect was sufficient to prevent further freezing, so that adequate capacity to carry off the gas remained.

Proportional weirs assure constant velocity through Springfield grit chamber

Plant Effluent Only Flow in River

The plant effluent is discharged into the Sangamon River. For several months following the past July the water demands of Decatur exceeded the river flow at the water-works dam, so that storage in the reservoir was called upon to make up the deficiency. With no water overflowing the dam, the entire flow of the river was, in effect, diverted through the city, routed to the sewage-treatment plant, and then returned to the riverbed without dilution. Ordinarily this condition of low flow occurs for a week or so during each summer, but its duration in 1930 was more than four months, an unprecedented occurrence.

About 55 miles below Decatur, on the same river, is the Springfield water-works. Fortunately, however, natural purification, in addition to the sewage-treatment processes and the Springfield water purification, effectively safeguards the health of the community. The water behind the Decatur dam has a biochemical oxygen demand of about 2.5 p.p.m. After passing through the city water-works system to the sewage-works, that demand has increased to 150 to 250 p.p.m., and after treatment has been reduced to 5 to 10 p.p.m. During its flow toward Springfield the sewage is subjected to the further purifying action characteristic of flowing streams and to dilution by water from lower drainage areas. As a result the biochemical oxygen demand of the water flowing past the Springfield intake is 2.5 to 3 p.p.m., not greatly in excess of that above the Decatur dam.

Observations at Springfield indicate that the maximum degree of pollution occurs during medium river stages. At times of extremely low flow natural purification proceeds as has been described. As the flow increases, the time of travel between Decatur and Springfield becomes shortened and the decreased purification effect is not sufficiently compensated for by the increased dilution. The load upon the Springfield water-purification plant thereby increases until a stage is reached at which the dilution becomes the predominating factor in purification. At higher stages the pollution load decreases until the lowest figure is reached at flood stage.

Softening is effected at the Springfield water plant by the addition of lime, followed by sedimentation with continuous sludge removal. The lime sludge is lagooned on the site of the plant and is much sought after by the farmers of the community after it has dried. Lime sludge does not dry readily, however, and below the first few inches the material remains soggy for many months.

Rapid filtration completes the purification of the settled water. The sand grains in the filters become materially larger in time due to the accretion of calcium carbonate, and the material has to be replaced periodically. According to Charles H. Spaulding, the plant superintendent, it is cheaper to replace the sand when its grains have become too large for satisfactory use than to employ recarbonation. Application of ammonia gas in conjunction with chlorination has been practiced for some time and is considered quite successful in eliminating unpleasant tastes and odors from the water.

Proportional Weir at Springfield

The new sewage-treatment plant at Springfield presents an excellent example of up-to-date design practices. Operating on the activated-sludge principle, it contains grit chamber, primary settling with sludge-removal equipment, aeration, secondary settling, heated sludge-digestion tanks and covered sludge-drying beds. Because of limitation of funds the plant has not yet been made large enough to treat completely all the sewage of the district, so that only 30 per cent of the effluent from the preliminary settling tank goes to the aerators, the remainder being bypassed to the river. As soon as money for construction becomes available to the Springfield Sanitary District, the intention is to add aeration and final settling units until the entire sewage flow can be treated.

A power-operated rake has just been installed at Springfield for cleaning the bar screens just ahead of the grit chamber. The ends of the rakes are attached to endless chains whose travel is parallel to the screens, and an electric motor drives the sprocket over which the chain

passes. To keep a uniform velocity of flow through the grit chamber regardless of the amount of sewage to be handled, the outlet of each compartment is in the form of a proportional weir, the crest of which extends across the whole compartment width. With a weir of this shape the discharge is in direct proportion to the head on the weir, so that the depth of flow above the level of the crest will be proportional to the amount to be handled. As the side walls of each compartment are parallel, the result is a constant flowing-through velocity.

The two preliminary settling tanks are provided with different types of sludge-removal equipment, one tank having rotary plows pivoted at the center and driven by traction at the perimeter, and the other having parallel scraper boards attached to an endless chain drawing the sludge to troughs at the basin end. Comparisons can likewise be drawn between two different methods of operation in the sludge-drying beds, inasmuch as half the area is covered with a greenhouse structure while the remainder is open to the air.

The gas from the sludge-digestion tanks is collected under floating steel covers. Its heat is utilized to maintain an optimum temperature in the digestion tanks and thereby accelerate decomposition. The heating requirements of the main building are also taken care of by the gas.

Springfield's laboratory facilities might well serve as a model for medium-sized sewage-treatment plants. Routine chemical analyses are conducted in a large well-lighted room, while a smaller adjoining room is given over to bacteriological work and special research problems. Every inducement is offered to encourage efficient and scientific operation by the technical staff.

A Fish-Breeding Station

Immediately adjoining the aeration tank is the completed excavation for the future units. Some months ago the water with which this hole became partly filled was stocked with sixteen top minnows. These tiny fish include mosquito larvæ in their diet and thus become extremely valuable in mosquito-control work. They are very prolific, and the excavation which originally contained only sixteen now appears to be filled with millions. The Illinois state department of health uses this colony as a source of supply from which to ship minnows to all parts of the state in its program of mosquito control.

Scientific Advances at U. S. Bureau of Standards

A VARIED LIST of achievements in the field of applied science is cited by George K. Burgess, director of the U. S. Bureau of Standards, in his annual report to the secretary of commerce, recently made public.

One of the most important developments reported by Dr. Burgess is the realization after many years' effort of a new absolute standard of light, which it is believed will eventually supplant the artificial standards, such as carbon lamps, which are now used as standards of candlepower by the various nations. The new standard involves a measurement of the brightness of the interior of a small tube of refractory material immersed in a bath of pure platinum. The brightness of the interior of the tube has been found to equal 58.84 candles per square centimeter.

Developments in the radio field require more and more precise measurement of frequency. By means of a special installation of four quartz oscillators and auxiliary machinery, including automatic photographic apparatus, it is now possible at the bureau to measure radio frequency with an error of only about two parts in ten millions.

The services of the bureau to the aeronautic industry are reported as especially noteworthy. The laboratory at Arlington, Va., has been used during the year in the endurance testing of each new type of commercial airplane engine for the aeronautics branch of the department of commerce, and certificates are granted by the department only for those engines which meet the bureau's requirements. Three engines can be tested at one time at present, and equipment for a fourth test stand will soon be installed.

Many tests have been made on the special light alloy used in constructing airplanes and airships. To determine the effect of repeated vibration on duralumin, a special machine is in use in which the specimen is floated on air and is caused to vibrate by high-speed air stream at a rate of 210 cycles per second. Through the use of this machine it is possible to carry tests to 200,000,000 cycles or more within a comparatively short time.

Through an extensive cooperative investigation on the properties of railroad rails during the period of fabrication, it has been found that owing to the low ductility of certain kinds of steel and the temperature at which rails are rolled, there is a tendency for the formation of nuclei within the rails, from which transverse fissures may later develop in service. Certain changes in the manufacturing procedure are suggested as a means of correcting the evil.

In the semi-commercial plant maintained by the bureau and the Iowa State College at Ames, Iowa, wallboard ½ in. thick and twice as strong as any on the market has been produced from cornstalks. The process is now being used commercially.

Under the auspices of the American Society for Testing Materials a cement reference laboratory has been established at the bureau to standardize testing procedure and methods in the numerous cement laboratories throughout the country. Inspection trips are made by the personnel of this laboratory, and their services have been in constant demand.

A series of filters has been developed by which the character of artificial light sources can be changed to that of sunlight, and one of these has been recommended for adoption as an international standard by the Seventh International Congress on Photography.

During the year an interesting extension of the bureau's simplified practice work has taken place. In the past this has been confined almost entirely to production, but recently simplified practice methods have been extended to the fields of distribution and consumption, and important progress is being made on the simplification of containers and packing methods. Satisfactory progress is also recorded in the fields of specification and commercial standards.

The number of tests completed by the bureau during the year was 200,726, with a fee value of $683,614—a substantial increase over last year, when the figures were 173,512 and $544,402. In the regular series of the bureau 194 papers were published, and about 240 papers were published in outside journals.

What We Know of Fatigue

A summary of present knowledge of endurance of metal under repeated stress

MANY THOUSANDS of laboratory tests have been made in the last ten years to discover how and why metal under repeated stress, as in springs, machine parts and structures, fails in the course of time, although amply strong under a single loading or even under permanent steady load. The phenomenon itself, this apparent wearing out of material, was discovered about 60 years ago, but only the tests of recent years have brought together any extensive knowledge concerning it. It is now known to be a highly complex action, involving many factors. Most metals have a definite endurance limit, a stress below which fatigue failure does not occur; but this limit depends greatly on the condition of the metal and of the stress.

To correlate the steadily accumulating knowledge on the subject, the American Society for Testing Materials two years ago appointed a special research committee with a view to bringing together and comparing the current additions to our information on the subject. This committee, made up of men widely known for their brilliant work in fatigue study, has just published a valuable summarized statement of present knowledge, which it plans to supplement from time to time with reports of new developments. Below is given a condensation of the main engineering facts contained in this statement.

Individual sections of the statement were written by J. R. Townsend, R. R. Moore, H. S. Rawdon, Prof. J. B. Kommers, R. L. Templin, H. W. Gillett, T. M. Jasper, R. E. Peterson, and Prof. H. F. Moore, chairman of the committee. Their joint work represents the most precise and complete record of fatigue knowledge available. Copies of the complete report will appear in the 1930 *Proceedings* of the American Society for Testing Materials, and a limited number of preprints of the report may be obtained now from the offices of the society.—EDITOR.

LONG-TIME tests run by H. F. Moore at the University of Illinois have established the fact that a steel which will withstand 10,000,000 repetitions of a certain stress will not fail within 100,000,000, and he has gone so far as to show in at least one case that this can be extended to 1,000,000,000 repetitions of stress. This does not hold for non-ferrous metals. R. R. Moore has shown that for manganese bronze the limit is at 13,000,000, and for elektron metal about 28,000,000 repetitions. He has also shown that certain duralumin specimens give no indication of having reached an endurance limit up to 400,000,000 repetitions of stress. Gillett did not find an endurance limit for naval brass at 50,000,000, and H. F. Moore did not find one clearly defined for a certain sample of monel metal at 750,000,000 repetitions. On the other hand, R. R. Moore located an endurance limit for extruded manganese-base alloys at 600,000 repetitions.

In order to shorten the time of test, various accelerated tests have been investigated. Among these are examination of the hysteresis loop, magnetic exploration, rise of temperature, and change in rate of deflection. Each of these methods has been shown to be inapplicable to all metals. The rise of temperature and change in rate of deflection methods are only fairly satisfactory on wrought ferrous metals and fail to indicate correctly the endurance limit of a number of non-ferrous metals. The rate of deflection method has been shown to give erroneous results on damaged specimens and on high-strength steels. The magnetic method has given erroneous results due to release of internal stress during the test.

From our present knowledge of the nature of fatigue failure, it would appear that a satisfactory accelerated endurance test must be sensitive to any nucleus that could develop into a crack that will propagate and ultimately cause a failure in a long-time endurance test. There appear to be but two methods so far suggested that are logical from this point of view.

One of these methods is the inertia test such as that of McAdam, in which, when failure starts, the deflection and the load both increase. Stress does not increase until either slipping or incipient cracking starts, but then increases, and thus hastens failure. However, this method will not necessarily work in the cases where slip can occur at stresses that will not cause failure. It should give safe but not necessarily true results.

The other is the Ikeda method, which is designed to tell when actual cracking starts. It is based on sound theory: detection of the development of a crack by noting a change in the electrical resistance of a specimen. It has promise and is worth more research but has not been sufficiently tested.

Correlation With Other Properties

There is no direct relationship between the endurance limit and any of the other physical properties which will hold for all metals. In steel, according to Gillett, there is a broad generalization that the endurance limit for completely reversed stress is very nearly directly proportional to the tensile strength or the Brinell hardness number, being roughly one-half of the tensile strength. This relationship does not hold for steels having a Brinell hardness greater than 400. The endurance limit of the non-ferrous metals does not bear any definite relation to the other physical properties. To further complicate the relation between fatigue failure and the short-time tests, many non-ferrous metals show endurance limits considerably higher than the proportional elastic limit.

There is no direct relationship between the static proportional limit and the endurance limit for completely reversed stress. No general relation exists between the fatigue strength of a steel and the yield point, the ratio varying from 1.31 to 0.53. For wrought ferrous metals below 400 Brinell, the fatigue strength is approximately 250 times the Brinell hardness number. No correlation exists between reduction of area (an index of ductility) and the fatigue strength. For cast ferrous metals the fatigue strengths may be considered as approximately 0.26 per cent of the modulus of rupture.

Range of Stress

The number of experiments performed to determine range of stress is very small compared with the number of tests that have been made in reverse bending. Diagrams involving tension and compression seem to indicate that the range of stress is not constant, but that as

the maximum stress increases the range of stress decreases. Diagrams involving torsion stress seem to indicate, on the other hand, that the range of shearing stress is practically constant. Since under most conditions it is not desirable to have materials permanently deformed, it follows that the elastic limit of a material should not be exceeded, even though a diagram on range of stress shows that the maximum unit stress might exceed the elastic limit.

Relation to Structure

The response of a metal to fatigue stresses—that is, repeated cycles of stress—is essentially the same in nature as it is to a static stress. Slipping on certain crystal planes occurs within the body of individual grains of the metal specimen, and the path of the fracture is transcrystalline. For some metals slip bands will result from cycles of stress whose magnitude is considerably less than the fatigue range. Evidently, the presence of slip bands on the surface of a metal specimen under fatigue stresses is not necessarily to be interpreted as evidence of incipient failure.

On account of the general strengthening effect of intercrystalline boundaries, it would be expected that the endurance limit of a specimen consisting of an aggregate of a large number of grains would be higher than that of a specimen of the same material composed of only a few relatively large grains or even only one. In general, however, for ordinary commercial materials the increase in the endurance limit secured by grain refinement is true only to the extent that the tensile strength is also increased.

Inclusions, often grouped under the term "dirt" in the structure of a metal, are not favorable to high endurance values. Internal separations, such as "shatter cracks" found within railheads, locomotive tires and similar rolled-steel products, serve as nuclei from which fatigue cracks progress, since these defects are usually located transversely to the direction of stress. Non-uniformity in structure may often be very detrimental with respect to the fatigue-resisting quality of a material, particularly if the non-uniformity consists in the segregation of inclusions or a hard, brittle, structural constituent. The crack once started in the structurally weak portion is propagated into the sounder portions as a result of the stress-concentration effect. There is some evidence to indicate that this may also be so in the case of some metallic coatings, if the coating is of a hard brittle nature.

Nature of Failure

In all cases in which it has been possible to observe the progress of fatigue failure in a specimen or a machine part, there has been noted a crack which spreads under repeated loading to final fracture. While in many cases fatigue cracks seem to arise from slip, in certain materials (notably in duralumin and antimony) fatigue cracks have been observed before there was present any evidence of slip. In general, the effect of any cracks or marked surface irregularities is disastrous owing to the stress-concentration set-up.

Detection of Incipient Failures

A periodic inspection method frequently used in some railroad shops to detect incipient failure is the oil-whiting test. In locating submicroscopic cracks by this method, the surface of a part to be examined is first painted with a film of oil and lampblack, which is allowed to soak in and is then wiped off. The surface is then covered with a wash of whiting and alcohol. After this coating is dry the part is struck with a hammer, and if the oil and lampblack have penetrated any cracks they will be forced out and will leave a black mark on the white coating.

A method of detecting cracks applied by the American Steel Foundries is to subject a casting to repeated stress in a special testing machine. When a crack is expected, the surface is sprayed with gasoline. With further repetition of stress the gasoline penetrates a small crack and forms a line of bubbles, which marks its location.

Another method which has been found useful in detecting very small cracks in iron and steel plates is that developed by Rawdon and his associates at the Bureau of Standards. In this method the piece to be examined is polished, magnetized, and covered with a wash of kerosene in which is suspended "iron mud" from lapping disks. Cracks are then located by the gathering of the iron mud particles along the cracks.

R. L. Sanford of the Bureau of Standards was unsuccessful in attempts to detect internal fissures in steel rails by magnetic means. The success of a magnetic method described by Suzuki of the Japanese Government Railways has not been substantiated.

The general principle of the electrical resistance method has been used with marked success by Sperry to detect incipient fissures in steel rails. This method seems to be fairly well established, although some difficulty in the interpretation of results has been experienced in common with the magnetic method.

Alloying and Heat Treatment

The endurance limit of sound, clean, wrought steel is roughly half the static tensile strength for all steels ranging from pure iron up to those heat-treated to a Brinell hardness of about 400, irrespective of structure. They may contain ferrite only, ferrite and pearlite, troostite, sorbite, considerable martensite, or be partly or wholly austenitic, without materially altering the endurance ratio. Neither is grain size of any particular effect. Any marked drop in the endurance ratio is due more to dirtiness of the steel or to the presence of other internal defects than to structure or composition. Any marked increase in the ratio is more probably due to cleanliness of the steel above the commercial norm or to exceptional absence of internal stress than to the presence of any particular alloying element or of any particular metallographic structure resulting from heat treatment.

When the Brinell hardness of the steel rises much above 400, as in steels of spring temper, the endurance ratio tends to be less than 0.50 but may often be brought close to it by a prolonged draw which will remove internal stress.

Steels vary greatly in their susceptibility to the effect of surface notches. In a laboratory test on a polished bar this variable is eliminated; in practice it is not. In general, hard steels, however their hardness is obtained, are more susceptible to the "notch effect" than are softer or tougher steels. If a part, like a spring, is to be used with a rough, notched surface, the service endurance limit will fall astonishingly from the laboratory endurance limit on a notchless specimen. The rate of propagation of a surface notch becomes significant in service. For springs, for example, one eye should be kept on the laboratory endurance limit and the other on the notched-bar impact value or some similar measure of toughness.

An outstanding conclusion from experimental data is that the fatigue strength of steel may be greatly increased by suitable heat treatment, especially in the case of high-

carbon steels and alloy steels, for which the increase may be as high as 200 per cent.

If in the life of a structure an occasional overload occurs, due to occasional carelessness in operation or unforeseen circumstances, such overstressing will not in general materially affect the life of the structure. The effect of occasional overstress depends on the kind of material used, (brittle or ductile). Occasional overstress within the yield point of a tough, ductile material has very little effect on the life of a structure in service.

Cold Working

Such cold working as affects the ultimate strength of the metal also affects the fatigue strength in a similar manner; that is, if cold working increases the ultimate strength of steel then it increases the fatigue limit in about the same proportion. However, violent cold working tends to start fracture in the internal structure and sometimes on the outside surfaces of metals, and when such is performed the fatigue strength is decreased.

Understressing

If a specimen is first tested under a repeated stress at or slightly below the endurance limit and is then subjected to a higher repeated stress, say one at which a virgin bar would fail in a few hundred thousand cycles, an astonishing result is obtained: the specimen will endure many million cycles. It has been definitely strengthened by understressing. The phenomenon has every evidence of the effect of cold working, except that no appreciable change of dimensions of the specimen occurs. If it is cold working it must be cold working on an extremely minute, submicroscopic scale.

Different materials vary in their ability to be strengthened by understressing, and at present we cannot predict without trial whether a given alloy will respond greatly or slightly to understressing.

Stress Concentration

If a specimen having an abrupt change of section is subjected to fatigue loading, a reduction of strength is obtained due to stress concentration, whether the material is ductile or not. The stress-concentration factors as obtained by fatigue tests are in all cases lower than the corresponding factors obtained either mathematically or photo-elastically. Fatigue stress-concentration factors tend to follow the same general tendencies in terms of dimensional relations, as is indicated by theory, except in the case of very fine discontinuities, where the fatigue values approach a condition of no effect.

Fatigue stress-concentration factors for cast iron are considerably lower than for steels, the reason apparently being that the flakes and holes inherent in cast iron produce considerable stress concentration, so that the effect of an imposed discontinuity is somewhat masked.

Some of the alloy steels, such as chrome nickel, seem to be more sensitive to stress-concentration effects, a property that is called the "tenderness" of a material.

Field Notes on

Water-Supply Conditions in the Drought Regions

THE EFFECT of the 1930 drought upon the water supplies of many communities in regions where the greatest deficiencies in rainfall occurred has been the subject of a series of notes by one of the editors of *Engineering News-Record*, published in recent issues. The following comment upon conditions in Ohio, Maryland and Viriginia concludes the series. The previous notes were published in the issues of Feb. 26, p. 366; March 5, p. 405; March 12, p. 452; and April 2, p. 565.

Recent rains have brought temporary relief to most of the affected communities, but the danger of further shortage is not entirely past in many instances. Reserves in surface reservoirs are still depleted; and more serious still, subsurface water supplies, which are much less responsive to local rains, are far below normal. —EDITOR.

RICHMOND, VA.

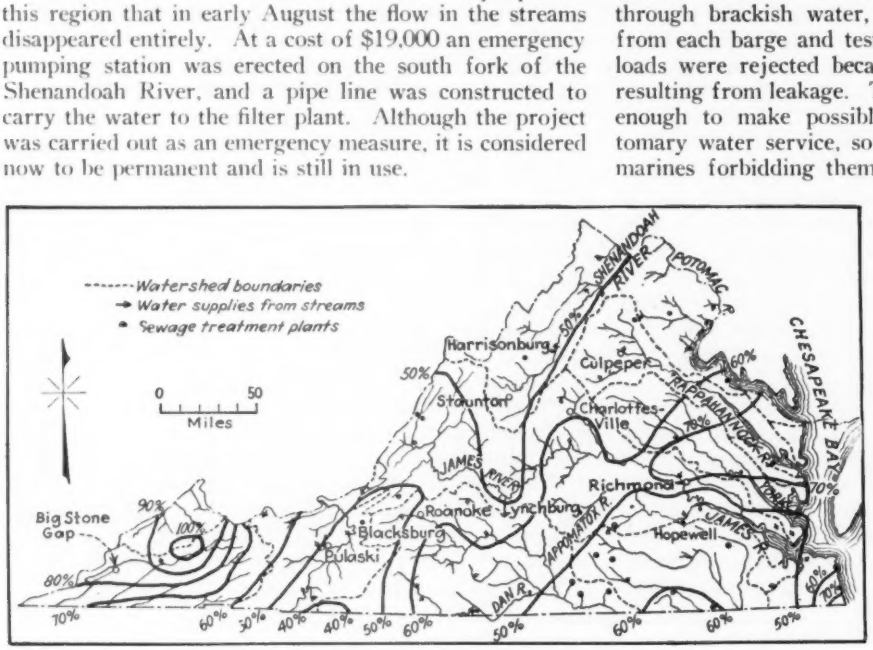
OF THE 244 public water supplies in the state of Virginia 36 communities had to resort to emergency measures during the drought. Fifteen months have been recorded so far having a rainfall deficiency. Although the acuteness of the condition was relieved during December, the depletion of groundwater reserve renders surface supplies particularly vulnerable to a continuance of the drought during 1931. It was in the Shenandoah Valley that the embarrassment caused by depleted water supplies was most keenly felt.

The period of dry weather started in Virginia in December, 1929. Throughout 1930 it continued, and although December rainfall came within 2 per cent of normal, the total for the year was but 60 per cent of what has been considered normal rainfall. The hope that the December rains marked the ending of the drought was not realized, however, as the first month of this year showed a precipitation of but 1.6 in., 47 per cent of normal. The dryest part of the state lay just east of the West Virginia border, and it was in that section that water supplies were most seriously depleted.

Old Spring Supply Put Back in Service

Staunton, with a population of 12,000, has an impounding reservoir on the North River which has a capacity of 124 m.g. In the latter part of October the reservoir held only 25 m.g. of highly colored water. The flow in the stream entering the reservoir fell to 0.1 m.g.d. Prior to 1926, when the North River reservoir was put into service, the supply for the town was taken from a group of limestone springs. At one of the springs the old pumping equipment was still intact and, together with the spring discharge, was pressed into service when the reservoir supply became exhausted. Although the consumption by the town was ordinarily 1.3 m.g.d., it was only possible to obtain 0.8 m.g.d. from this source. To use the other spring necessitated the construction of 3,000 ft. of 8-in. pipe line and the installation of emergency pumping equipment. When those measures were taken the springs made available a flow of 3 m.g.d. The total investment involved in the emergency construction was $7,500, and it avoided the necessity for any curtailment by the town in its use of water. During the time the emergency supply was in use chlorination was the only treatment the water received. The reservoir on North River began to fill in December, when streamflow began to pick up, and the spring supply was discontinued on Dec. 22. By Jan. 6 the reservoir had again been filled to capacity and was overflowing.

Front Royal, with a population of 2,400, has no impounded storage but takes water directly from two small surface streams carrying very euphonious names, Harmony Hollow and Happy Creek. The total watershed area tributary to the water-works is 8.3 square miles. So serious was the effect of the dry spell in this region that in early August the flow in the streams disappeared entirely. At a cost of $19,000 an emergency pumping station was erected on the south fork of the Shenandoah River, and a pipe line was constructed to carry the water to the filter plant. Although the project was carried out as an emergency measure, it is considered now to be permanent and is still in use.



Rainfall distribution over Virginia during 1930
Figures represent per cents of normal during year.

Strasburg's water supply is taken from a group of nine springs and also from an impounding reservoir with a capacity of 20 m.g., located in Little Ford Valley. The reservoir is on the far side of Massanutten Mountain; and to bring the water to the town it had been necessary to drive a tunnel 1,664 ft. long through the mountain. On the near side of the mountain there is a connection to the group of springs, so that the flow from both sources might be available. In early summer the reservoir contents were completely exhausted, and the flow from the springs had decreased to a mere trickle. Less than 10,000 gal. daily was available for use. Near by was an abandoned quarry hole containing 28 m.g. of water. An emergency pump was installed and 3,000 ft. of 4-in. threaded pipe was laid to carry the water from the quarry to the reservoir. To make the quarry's contents last as long as possible, service to industrial consumers was discontinued. Even so, the water in the quarry became exhausted in December. For the following three weeks the only supply available to the town was the small amount that had accumulated in the reservoir during the period that the quarry water had been used. With such a small amount available it was impossible to give continuous service to the consumers, and the pumps were operated but a few hours each day. The emergency equipment was then connected to a spring that produced 0.2 m.g.d. By the end of February the water level was slowly rising in the reservoir, but the spring supply was still being used.

Barges Bring Water to Quantico

In the middle of August the flow in Chopawamsic Creek, from which the Quantico marine camp takes its water supply, had fallen so low that it was necessary to operate the water-works only intermittently. The pumps were in service for 15 min. out of every three hours. Filtered water was brought in barges from the water plants at Norfolk and Indian Head and forced into the Quantico distribution mains by an old fire pump, after chlorination. As most of the transportation distance was through brackish water, samples of water were taken from each barge and tested for salinity. Several barge loads were rejected because of too high a salt content resulting from leakage. The amount transported was not enough to make possible the resumption of the customary water service, so that orders were issued to the marines forbidding them to use the water for bathing. Later, to conserve the supply further, 3,000 men were sent home with a month's leave. Such emergency measures were continued until flow was re-established in the creek in the latter part of October.

Tidewater Virginia has experienced an increased mineralization of its water supply during the drought months similar to that which occurred in the inland states, and in addition has had the problem of increased salinity to struggle with. Because of the low flows in the surface streams entering tidewater, salt water has traveled by diffusion miles farther up fresh-water streams than it has ever done before. This action has had a marked effect upon the aquatic life of the rivers, with fresh-water fish and vegetation being destroyed and supplanted by salt-water forms.

Groundwater Supplies Depleted in Ohio

Public water supplies in southern Ohio have suffered serious depletion as a result of the drought conditions, but practically all cases of acute distress have now been relieved. Up to the present time the embarrassment has been confined to surface supplies, but there are strong indications now that deep-well supplies are beginning to experience distress. In addition to the difficulties incident to depleted sources, troublesome tastes have developed along the Ohio River.

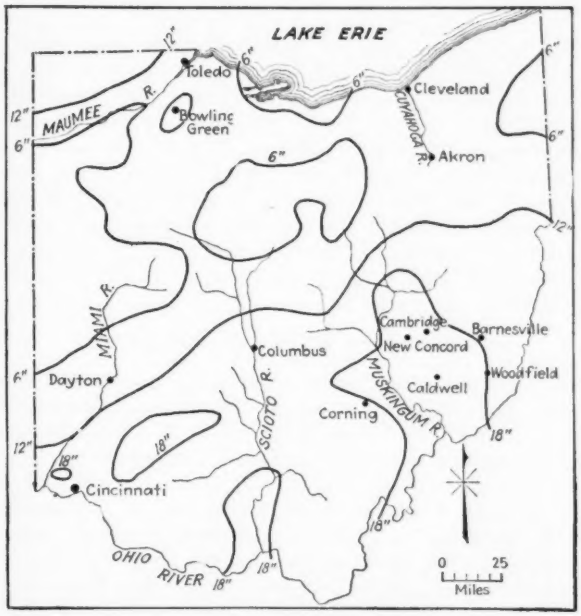
Although the northern portion of the state was the first to experience the rainfall deficiency, it was in the southern and southeastern counties that the drought attained its greatest severity. For the state as a whole the first two months of 1930 had an excess of precipitation, but starting with March, each succeeding month to date has shown a deficiency. The rainfall for 1930 was but 27 in., or 71 per cent of its normal value, with the deficiency increasing rather regularly from Lake Erie southward to the Ohio River. In some of the counties near the West Virginia border, with a normal annual precipitation of 42 in., only 20 in. of rain fell. Records for January and February of this year show the drought continuing with unabated force.

As a result, streamflows suffered serious depletion. The Maumee River fell far below its previous low record attained during the dry year of 1925; and White Oak Creek, a small tributary of the Ohio River, dried up completely at a point where the contributing drainage area was 221 square miles. As a rule, however, stream-

flows were maintained to some degree by the reserve of groundwater accumulated during the wet monthts at the beginning of the year. A condition of depleted groundwater reserve prevails at the present time, so that a repetition in 1931 of last year's rainfall deficiency would occasion streamflows far lower and water shortages more serious than were experienced during 1930.

Southern Ohio Supplies Affected Most

Practically all of the depleted water supplies have been in the southern part of the state. In December Barnesville's 100-m.g. reservoir gave indications of approaching exhaustion. Two emergency dams were constructed on nearby streams, increasing the area tributary to the water-works of 1 square mile to 4 square miles, and a two-mile pipe line was built to bring the impounded water to the existing reservoir. An emergency pumping station was constructed to lift the water the 300 ft. necessary. The introduction of restrictive measures on the use of water reduced the town's consumption from 0.4 to 0.2 m.g.d. A creamery, one of the largest consumers of water, installed new recirculating equipment and thereby cut down its consumption



Rainfall distribution over Ohio during 1930
Figures represent inches of deficiency during year.

from 100,000 to 5,000 gal. daily. A few light rains occurred in the middle of January and occasioned enough runoff on the newly developed watershed to allow the emergency pipe line and pumping station to be put into service. On Jan. 21, when water from the emergency supply first became available, the level in the old reservoir stood more than 20 ft. below the crest of the spillway, and the intake pipe to the filter plant was covered by only 10 in. of water.

But the relief was only temporary, and two weeks later the intake was covered by only 3 in., despite the additional amount produced by nine new drilled wells. Since the previous December the town had been drawing on what had ordinariily been considered fire reserve; but by early February conditions had become so acute that plant piping was so changed as to make possible pumping to the filter plant the water in the reservoir below the intake pipe. More generous relief was received on Feb. 13, when a 1-in. rainfall occurred and raised the water level 11 in., equivalent to two weeks' supply. Since that time the water in the reservoir has been slowly rising as a result of light rains.

Mine Drainage Used in Emergency

When flow ceased in Wills Creek last summer the town of Cambridge, with a population of 16,000, was forced to resort to the water contained in abandoned coal mines. Ordinarily, water is pumped from Wills Creek to a storage reservoir, from which it flows by gravity to a filter plant. For four months last fall the mine drainage was used, water being taken from one mine until the salinity and acidity rendered it unfit for use, after which another mine was made available. Flow was re-established in Wills Creek in November, and since that time the use of mine drainage has been discontinued.

Taste in Ohio River Water

In those cities taking water from the Ohio River considerable distress was experienced, occasioned by the disagreeable taste which developed during the long period of low flow. As noted in previous comment on conditions at Louisville, Ky., the Ohio River for many months consisted of a series of long pools of nearly stagnant water. The consequent decay of organic material and the increased concentration of dissolved solids and industrial waste combined to form what was referred to as a "river taste." The employment of excess lime as a disinfectant and the discontinuance of chlorination served greatly to minimize the taste problem at Bellaire and Ironton, Ohio. At Delaware successful use was made of potassium permanganate for three days, the chemical being applied at a rate of 3 lb. per million gallons, followed by lime treatment to precipitate the manganese. The ammonia-chlorine process was used at Warren, Marietta and other places, and although it prevented tastes of a phenol nature, it was unsuccessful in modifying the characteristic river taste. Activated carbon was used at the Huntington, W. Va., plant, which also supplies Chesapeake, Ohio. The application of powdered carbon to the raw water was found to be successful in removing the disagreeable taste.

Hardness also increased in the Ohio River water and its tributaries. At Cincinnati the total hardness increased from its average amount of 100 p.p.m. to 232 p.p.m. in December. The hardness of the Scioto River water at Columbus arose to 375 p.p.m.

Another effect of the long-continued spell of hot dry weather was to increase the maximum rate of pumpage of water. The ratio of maximum hourly consumption to average daily consumption at Columbus increased from its previous value of 1.85 to 2.15.

Deep Wells Now Approaching Danger Point

Deep-well supplies held up satisfactorily throughout the period of depleted water supply. Shallow dug wells, however, and many private drilled wells of moderate depth were not able to stand the strain during the rainfall-deficiency months, and in the rural districts much hardship resulted. Now that the underground reserve has been depleted by maintaining the flow of surface streams, the water table has dropped to a point where it is causing the failure of some of the deep wells.

The Ohio state department of health for some years past has carried out a program of examining well supplies in the rural districts, especially those located along

heavily traveled roads and used for semi-public purposes, and of presenting what is called the "seal of safety" to those that meet a particularly high standard. The basis for approval is such that only the exceptional dug well or shallow drilled well can qualify. The experience during the past year has been that practically no distress at all has been experienced with those wells bearing the state department's seal. The result has been the development of a high degree of appreciation by the people in the rural districts, as to the value of a seal-of-safety well. At the present time the state is capitalizing this experience by drilling a number of deep wells, paid for out of state funds, in a number of strategically located positions, all built under rigid specifications and in most cases on community property. More than 60 of these wells are to be drilled in the counties that suffered most from the effects of the drought.

FLOW OF SELECTED STREAMS IN OHIO DURING THE DROUGHT

		Hocking River at Athens, O. 944 sq.mi. 1914–1930			Whiteoak Creek near Georgetown, O. 221 sq.mi. 1923–1930			Muskingum River at McConnelsville, O. 7,410 sq.mi. 1921–1930			Racoon Creek at Adamsville, O. 537 sq.mi. 1914–1930			Scioto River at Chillicothe, O. 3,850 sq.mi. 1920–1930		
		Actual Flow, Sec.-Ft.	Normal Flow, Sec.-Ft.	Per Cent	Actual Flow, Sec.-Ft.	Normal Flow, Sec.-Ft.	Per Cent	Actual Flow, Sec.-Ft.	Normal Flow, Sec.-Ft.	Per Cent	Actual Flow, Sec.-Ft.	Normal Flow, Sec.-Ft.	Per Cent	Actual Flow, Sec.-Ft.	Normal Flow, Sec.-Ft.	Per Cent
Oct.,	1929	398	393	131	57	84	68	2,460	2,550	97	228	208	110	2,840	1,400	203
Nov.,	1929	2,360	815	290	423	183	231	10,900	5,460	200	1,340	537	250	7,710	2,740	288
Dec.,	1929	1,650	1,350	122	407	333	122	11,400	9,390	122	668	882	76	8,830	4,930	179
Jan.,	1930	2,310	1,720	134	612	500	122	25,100	12,200	206	971	1,200	81	17,700	6,740	263
Feb.,	1930	1,590	1,820	87	520	504	103	12,200	12,200	100	1,100	1,410	78	8,200	6,040	136
March,	1930	2,240	2,140	105	214	346	62	16,200	14,800	109	1,560	1,520	203	6,750	7,300	90
April,	1930	910	1,380	66	157	293	54	7,490	11,300	66	540	1,010	54	2,310	5,810	40
May,	1930	179	1,120	16	8.0	199	4.0	2,700	8,110	33	79.6	856	9.3	800	3,750	21
June,	1930	77.8	876	9	7.7	201	3.8	1,360	5,620	24	29.3	497	5.9	470	3,050	15
July,	1930	52.2	487	11	1.0	140	0.7	711	3,870	18	11.3	280	4.0	303	1,510	20
Aug.,	1930	39.6	439	9	3.7	107	3.5	494	2,190	23	13.9	277	5.0	214	937	23
Sept.,	1930	44.8	354	13	2.8	74	3.7	631	2,720	23	3.3	166	2.0	233	1,060	22
Oct.,	1930	36.1	303	12	0.3	84	0.3	625	2,550	25	4.6	208	2.2	225	1,400	16
Nov.,	1930	51.4	815	6	0.2	183	0.1	784	5,460	14	10.9	537	2.0	254	2,740	9.3
Dec.,	1930	64.5	1,350	5	3.0	333	0.9	981	9,390	10	16.8	882	1.9	267	4,930	5.4

Maryland Experiences Dangerous Shortage

During 1930 the state of Maryland received relatively the lowest rainfall of the entire country—only 56 per cent of normal. Depleted supplies and increasing salinity in many communities throughout the state necessitated emergency measures to provide suitable water service.

Here, too, the drought began in December, 1929, and has continued with unabated force to the present day, with the exception of a slight amount of relief from rain during last December. For the year 1930 the entire state received 23.4 in. of rainfall, compared with its average precipitation of 41.8 in. Furthermore, January and February of this year have accumulated a considerable rainfall deficiency to serve as a handicap to a return to normal streamflow conditions.

Annapolis, the capitol of the state and the home of the United States Naval Academy, under ordinary circumstances uses 1.5 m.g.d., drawn from an impounded reservoir of 45-m.g. capacity. Early in June the level in the reservoir began to drop, and by the middle of August there was but 6 m.g. available. As an emergency measure a fire pump and 1,300 ft. of 2½-in. fire hose were pressed into service to pump water from an adjacent small stream to the depleted reservoir. While this equipment was in use drilling was started on a new well supply. The Naval Academy was able to help out for three weeks by pumping 200,000 gal. daily from its own well supply directly into the Annapolis mains. The depleted reservoir condition was aggravated by the abnormally high temperature and the relatively large expense of water surface, resulting in a tremendous loss by evaporation. In October, when the temperature decreased sufficiently to relieve the high rate of evaporation, the inflow from the regular stream and the auxiliary supply together were enough to meet the demands of the city. When the well was completed in November it yielded 1.5 m.g.d. It was put into service in the middle of February, and Annapolis is now out of danger.

The Washington Suburban Sanitary District supplies water to a number of small suburban developments in the environs of Washington. The filter plant and impounded reservoir on the Northwest Branch of the Anacostia River meets a normal demand of 3 m.g.d. In early July the level of water in the reservoir began to fall, and in a short while the reservoir was completely dry. It is estimated that the streamflow at that point has a long-term average of 18 m.g.d. Its previous low record was 2 m.g.d., but during August of the past year it dropped to 0.5 m.g.d. To avoid curtailment in the amount supplied the communities, the distribution system was connected with that of the city of Washington late in July and was not disconnected until this past February.

Susquehanna River Becomes Salty

An increase in salt content in the Susquehanna River water made it unfit for use by the towns of Havre de Grace and Perry Point. Ordinarily, the Susquehanna River water at that point has a salt content of but 7 to 8 p.p.m., but in September it had increased to 200 p.p.m. and reached a maximum of 885 p.p.m. in December. Both towns had to go to other sources for their water supply. Port Deposit farther up the river used a fire engine to pump water from the Susquehanna River into a fire hydrant on the distribution system when the flow in East Rock Run fell to 35 g.p.m. The emergency connection was in use for two weeks during last August.

Brunswick, on the Potomac River, obtains its water from springs in West Virginia carried under the river in a siphon. In the early part of the fall the spring supply failed, and the town was forced to go to the Potomac River for water. The topography is such that the only point available for an intake was about 600 ft. below the point of sewer discharge. The dilution resulting from the relatively large flow in the Potomac River, however, and the application of a heavy dose of chlorine at the intake prevented any disaster from this unfortunate condition.

Although the Baltimore supply did not become depleted to a point of danger, the water department requested the consumers to curtail demand when the level of the water behind Lock Raven Dam fell to 14 ft. below spillway elevation. When full, that reservoir contains 23 billion gallons, and at its lowest point last fall the contents had been reduced to 16 billion gallons.

Mixed-in-Place Road Surfacing in Vermont

Recombined crushed and screened gravel and crushed stone oiled, dragged, bladed and rolled for $1,000 to $4,500 a mile

By HAROLD L. TILTON
Department of Highways, Montpelier, Vt.

TWO KINDS of mixed-in-place oil-road surfacing are being constructed by the Vermont department of highways: (1) gravel with tar or asphaltic-oil binder; and (2) crushed stone bound with retread tar, cutback asphalt or emulsified asphalt. These mixed-in-place surfaces cost from $1,000 to $4,500 a mile, depending largely upon the thickness of surface desired and whether gravel or crushed rock is used, and upon the distance it has to be hauled. Such roads should require a light seal coat once in from three to five years. A great advantage of the mixed-in-place type of construction is that hand labor is reduced to a minimum, which cuts the cost and largely eliminates the need for specially trained labor except in the case of road-grader operators. For secondary roads and for temporary construction on some of the trunk lines a 2-in. mixed-in-place surface on an adequate well-drained base will provide a dustless, mudless, smooth-riding road throughout the year at a first cost which the traffic can afford and with a reasonable maintenance cost.

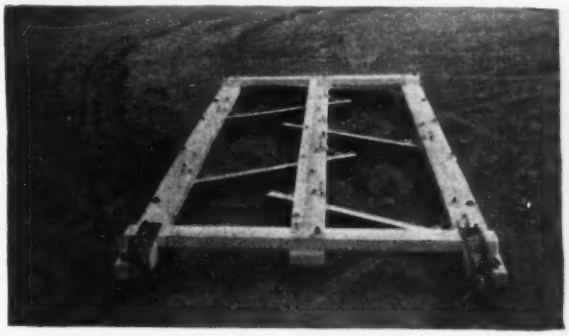
Gravel Construction—The road is properly drained, and an adequate sub-base of coarse gravel or stone is provided in all localities where the road breaks up in the spring. Upon this foundation a layer of gravel is spread and shaped by the road grader until traffic compacts it enough to permit the use of the drag. Depressions are filled as they develop. This gravel should contain as large a percentage as possible of stone ranging in size from ¼ to 1 in. As the result of experience thus far, all the gravel on large jobs in the future will be crushed, screened and recombined in the proportions desired, thus producing a gravel more uniformly graded and containing a greater percentage of stone. Furthermore, screened gravel can be spread mechanically at a saving in cost which offsets the cost of screening.

As soon as this gravel surface is true it is given an application of tar or asphaltic oil. The grade to be used will depend upon the type of gravel and the time of year. In midsummer a tar of viscosity 20 at 40 deg. C. is most suitable, while in September a viscosity of 12 would be preferable. A 66 per cent asphaltic oil with a viscosity of 122 at 25 deg. C. has given excellent results.

After the bitumen has attained its maximum penetration a drag is drawn slowly back and forth through the oiled gravel. This drag is about 14 ft. long and 6 ft. wide. The first course should be rather lean. The consistency may be regulated by adjusting the blades or by adding more gravel.

The following day a second application of bitumen is made, and a heavy covering of gravel is spread upon it. This is mixed by the drag as before, except that a richer consistency is required. A much heavier tar or oil is preferable for the second application. A retread tar with a viscosity of 42 has produced excellent results. The rate of application in each case is governed by the thickness of wearing surface desired. A commonly accepted rule is ½ gal. per square yard of surface for each inch of thickness. The drag automatically produces a smooth-riding surface, since it is in effect a 14-ft. straight-edge drawn in the direction of traffic. The third morning the surface is rolled to press all the stone into the surface, and the road is completed.

Crushed-Stone Construction—In constructing crushed-stone retread or mixed-in-place surface a light application, or tack coat, of bitumen is applied to the sub-base. Then a layer of crushed stone is spread upon the sub-base and bladed into shape by the grader. This layer is from 2 to 4 in. deep as may be desired. Then an application of bitumen is spread on the stone. The bitumen may be retread tar, cutback asphalt or emulsified asphalt. A retread tar of viscosity 45 at 40 deg. C. and a cutback asphalt with a 70 per cent residue of 90 penetration have proved quite satisfactory.



Standard Vermont road drag for mixed-in-place surfacing

The crushed stone which has been covered with this bitumen is then bladed into windrows back and forth across the road and is spread out and given another application. It is windrowed again until thoroughly mixed and is then spread out smooth and rolled when sufficiently cured. The rate of application of bitumen depends upon the depth of surface course and upon the size of the stone. For a given bitumen the amount will approximate that used with gravel. An application of bitumen, ⅛ gal. per square yard, is then applied to this surface and a coating of fine peastone spread on from trucks. Another application of bitumen, ⅜ gal. per square yard, is applied to the peastone. The drag is then drawn through the peastone, thoroughly coating them and filling them into the little irregularities which it is impossible to avoid in the blading.

Grade Crossing Accidents Decreased in 1930

Fatalities due to highway grade-crossing accidents were the lowest in 1930 for any year since 1922, according to complete reports for the year filed by the railroads with the Interstate Commerce Commission. During 1930, 2,020 persons lost their lives in grade-crossing accidents, a reduction of 465, or nearly 19 per cent, compared with the number of fatalities in 1929. Persons injured in such accidents in 1930 totaled 5,517, a reduction of 1,287 compared with the preceding year. In 1930 there were 4,843 accidents at highway grade-crossings, compared with 5,957 in 1929. This reduction took place in the face of an increase of approximately 4 per cent in all other fatalities on the highways. Class I railroads in 1929 spent $28,445,680 for additional protection to or elimination of highway grade crossings.

ENGINEERING LITERATURE

A Monthly Review of Books and a Listing of New Publications

Textbook on Properties and Mechanics of Materials

REVIEWED BY CLYDE T. MORRIS
Professor of Structural Engineering, University of Ohio, Columbus, Ohio

PROPERTIES AND MECHANICS OF MATERIALS—By Philip Gustave Laurson, M.S., M.Am.Soc.C.E., Associate Professor of Engineering Mechanics, and William Junkins Cox, C.E., Assoc. M.Am.Soc.C.E., Assistant Professor of Engineering Mechanics, Sheffield Scientific School, Yale University. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 353; tables and graphs. $3.50.

A VERY commendable feature of this book is the inclusion, almost at the start, of three chapters on the properties, manufacture and uses of the more important materials of engineering. Necessarily, this treatment is neither technical nor exhaustive, but it is sufficient to give the student a general idea of the fundamental processes of manufacture and differences in properties. The chapters are preceded by a more general consideration of properties of materials and their determination by tests. The section on testing might profitably be extended to cover the character of failure and interpretation of tests.

The four chapters just outlined occupy 113 out of 318 pages, exclusive of five appendices. Each of the remaining fourteen chapters is relatively short, which is an advantage in making assignments and in home study. The text is illustrated with a wealth of well-chosen problems, many of which are stated without the answers being given, which is also desirable from a pedagogical standpoint.

The statement is made in the preface that, owing to the limited time available in the usual engineering curriculum, the scope of the book has been limited to the fundamentals. It would appear that too much may have been sacrificed in cutting out demonstrations of theorems. The inquiring mind of many of the better students in any class will demand theoretical justification of many of the more or less "rule-of-thumb" statements given in the text, as, for instance, the development of Rankin's formula for columns instead of Euler's formula, and the sidestepping entirely of the secant formula for column deflections. Where, if not in a treatise on mechanics of materials, should a student get an insight into the theoretical basis upon which is founded the simpler methods used in practice?

The entire book is based upon methods used in the designing room and from that standpoint is very practical. The theorems are explained with extreme detail and 95 per cent of the book could be read with ease by a student who had never studied the calculus, although it is stated in the preface that a knowledge of graphic statics and the calculus is assumed.

At the end of the book is a table of references for further reading which should be extended considerably, to include many other equally valuable and perhaps to some more easily accessible texts on the subject. The appendices take up: (A) the calculus (5 pp.); (B) centroid and statical moment; (C) moment of inertia; (D) Euler's formula; and (E) tables of properties of standard steel shapes, allowable unit stresses for various materials, and other standards. Appendix A might well be omitted, and B, C and D should be included in their proper places in the text.

Railroad Valuation Analyzed

RAILROAD VALUATION AND FAIR RETURN: A Study of the Basis, Rate and Related Problems of Fair Return for American Railroads—By Shao-Tseng Wu, Ph.D., Traveling Fellow in Railway Economics, Ministry of Railways, Republic of China. Philadelphia: University of Pennsylvania Press. Cloth 6x9 in.; pp. 233; $3.

"FAIR value for rate-making purposes is not true economic value, but simply a rate base to which a fair rate of return is to be applied in determining fair earnings. . . . The process of fixing the value of the railroads is a process of collective bargaining between the railroads and the public—a process of determining the sum on which the public is willing to permit the railroads to earn a fair return." Briefly, that is the conclusion reached by Dr. Wu in his very readable analysis of the complicated operation of setting a value upon the property of the railroads of this country and of fixing a rate of return upon the property which will be fair both to the railroad and the public.

The author sees no possibility of nor justification for a fixed formula method of determining value for rate-making purposes. Neither original cost, cost of reproduction new nor capitalization can, in his opinion, be taken as the basis of valuation. He appears to believe that the Interstate Commerce Commission's valuation principles are close to the best that can be practically adopted.

Rate of return, the author holds, must be neither exorbitant nor confiscatory and should be no higher at any one time than is necessary to attract capital and executive ability. Whether it is better to fix the rate base or the rate of return depends upon the particular conditions to be met. The recapture provisions of the transportation act are, in the author's opinion, essential to an equitable adjustment of rates between railroad companies. He believes, however, that recapture should be on the basis of earnings over a period of years so that the surplus of busy years will take up the slack of dull years.

Contract Estimating in England

ESTIMATING AND COST KEEPING FOR CONCRETE STRUCTURES—By A. E. Wynn, B.Sc., Assoc.M.Am.Soc.C.E. London: Concrete Publications, Ltd. Cloth; 6x9 in.; pp. 258; halftones and tables. 15s. in England.

APPARENTLY English methods of estimating construction work and of keeping costs on contracts do not differ materially from those practiced in this country. Although the specific examples of labor and material estimates given in this volume are hardly applicable to construction work in this country because of the difference in methods of construction procedure, the

fundamentals of estimating and cost keeping as described can be applied to our work and are therefore of value. The author starts with quantity takeoffs and carries the estimating and cost-keeping procedure through labor and material estimates, plant costs, and cost-keeping systems after the contract is secured, and ends with a discussion of general bookkeeping methods suitable for contractors. Buildings, arch bridges and dams are the three major fields covered. The book is devoted entirely to concrete structures.

Leather Belting

TREATISE ON LEATHER BELTING—By George B. Haven, S.B., Professor of Advanced Machine Design, in Charge of Textile Research, and George W. Swett, S.B., Professor of Machine Design, Massachusetts Institute of Technology. New York: American Leather Belting Association, 41 Park Row. Cloth; 5x8 in.; pp. 249; tables and illustrations. $1.50.

ALTHOUGH leather belting has been used for a long time, information regarding its production, application, maintenance and the engineering connected with its use has been widely scattered. The American Leather Belting Association has gathered available material from its members and also tests and other data from various universities, and put them into the hands of Professors Haven and Swett. The result is a useful volume. The main subjects treated are: leather manufacture; physical properties of belting leather and manufacture of belting; belting practice and installation and care of belting; motor belts and belt-drive engineering; belt research, specifications and inspection. Though published by an association and distributed to its members, the volume contains no advertising. It is simply a straightforward presentation of leather belting from engineering to dressing, written in plain language from a practical standpoint. Engineer, millwright, purchasing agent and shopman will find it valuable.

County and Metropolitan Government

COUNTY GOVERNMENT AND ADMINISTRATION—By John A. Fairlie, Ph.D., Professor of Political Science, University of Illinois, and Charles Mayard Kneier, Ph.D., Associate Professor of Political Science, University of Nebraska. New York: The Century Co. Cloth; 6x9 in.; pp. 585. $4.

THE GOVERNMENT OF METROPOLITAN AREAS IN THE UNITED STATES—Prepared by Paul Studenski, With the Assistance of the Committee on Metropolitan Government of the National Municipal League. New York: National Municipal League, 261 Broadway. Cloth; 6x9 in.; pp. 403. $3.50.

HUNDREDS of millions of dollars are spent every year for public works and buildings by the 3,100 counties of the United States. Their activities overlap those of the cities in many ways. Neither the counties nor the cities nor the two combined cope satisfactorily with twentieth century's problems of urban growth. This deficiency is most evident in metropolitan districts, because of the greater number and magnitude of the problems there and the lack of any well-conceived and well-coordinated unit of metropolitan government. Many of the metropolitan areas lie in two or more counties and where they are confined to a single county it may be that only a part of the county is urban. Unlike cities, our counties were not created to supply such urban needs as water-works and sewers, and even now, in some parts of the country, do not build and maintain highways, or in fact do much except perform a few functions, such as those pertaining to peace and justice. All these and many other pertinent facts are brought out in two wide-ranging books, happily published about the same time and in a measure each supplementing the other: one on counties, the other on metropolitan areas. Both are well-organized detailed factual surveys, with critical comments interspersed.

Fairlie and Kneier's "County Government and Administration" merits first attention because it deals with existing institutions, including not only counties but also governmental units of lesser area on the one hand, while on the other it considers metropolitan and regional problems. This breadth of treatment is needed because in some states the counties do what lesser civil divisions do in other states, while elsewhere the reverse is true. In much the same way, metropolitan and regional activities have to do with operations such as are usually conducted on a smaller scale by cities or towns and sometimes by counties.

The book opens with a historical survey of local institutions in England and in the United States, the latter divided into the Colonial and the subsequent period. The relationship of the county and the state is next taken up under many heads. Organization of county government is given several chapters, as is also county administration. The authors then revert to local government, taking up the types peculiar to different parts of the United States. Next there is a chapter on county government in relation to metropolitan areas, city-county consolidation and metropolitan regions. The volume closes with a classified list of references, a table of legal cases and an index.

"The Government of Metropolitan Areas in the United States" is a most welcome contribution to writings on a subject that is growing rapidly in importance and has never before been treated comprehensively. It is hardly too much to say that the book deals with something that does not yet exist—that is, we have no system of government for our metropolitan areas; instead, there are many politically independent, overlapping, more or less conflicting governmental units, with little or nothing to coordinate them. For the most part, therefore, the book deals with partial systems and with projects that have failed. It takes as metropolitan areas some thirty cities and surrounding country classified as metropolitan by the 1920 census. These included a total of 921 minor civil divisions, located in 91 counties and 39 states, with a combined population of about 29,000,000, of which some 22,000,000 were in the "central city" of the several areas.

Attempts at effecting either a single metropolitan government or an approach toward one are reviewed under the heads: annexations and consolidations, city-country separation and consolidation and expansion of county government to meet metropolitan needs. Other and less comprehensive attempts described are special metropolitan authorities, generally dealing with a single class of public works, as water supply. New York City's borough plan, really an example of large-scale consolidation, has a separate chapter. Experiences under these various plans are critically reviewed, with such subdivisions as reactions on the central city and the outlying territory. A chapter on the federated city deals with a number of comprehensive projects that failed of consummation. By way of general conclusion there are two pages of remarks. These indicate that there is no single "best" plan for the government of metropolitan areas but that after careful study of local conditions some of

the plans analyzed may be found workable, if local, personal and political considerations can be kept down.

Both books show anew the badly tangled condition of local government in the United States. The tangle grows worse as the governmental units, actual or proposed, grow in area from city to county and from county to metropolitan and even larger regional areas. Although neither book goes far toward presenting a definite plan of disentanglement, each contributes to that end by its mass of carefully analyzed facts and by its well-considered critical comments. Inasmuch as most of the problems considered relate directly or indirectly to the construction and operation of public works, among which those to meet the future needs of metropolitan areas will be of staggering size and cost, these two books should have a strong appeal to engineers and also to progressive city officials generally.

Facts About Water Power

NATIONAL ASPECTS OF WATER-POWER DEVELOPMENT: A Review of the Facts—By the National Water Policies Committee. Washington, D. C.: Chamber of Commerce of the United States. Paper; 8x10 in.; tables and line cuts. $1.

WRITTEN primarily for the guidance of members of the Chamber of Commerce of the United States in reaching a decision on the questions raised by the chamber's referendum on water-power policies, held last fall, "National Aspects of Water-Power Development" will be found valuable to anyone wanting up-to-date information on federal laws affecting water power and water-power development. The book also covers trends in steam- and water-power development, the problems of rate structure regulation and valuation, federal and municipal power plants, and interstate compacts. Muscle Shoals, its nitrate plants and the subject of nitrogen and fertilizer take up a whole chapter. The appendices include a tabulation of developed water-power sites by states and a summary of the valuation laws of the several states.

High Promise Seen

SOVIET FOREIGN TRADE: Menace or Promise—By J. M. Budish and Samuel S. Shipman, of the Economic Division, Amtorg Trading Corporation. New York: Horace Liveright, Inc. Cloth; 5x8 in.; pp. 276; tables. $2.50.

THE authors of "Soviet Foreign Trade: Menace or Promise" have made distinctive contribution to the recent flood of books on Russia. As would be expected from their semi-official position, they see high promise rather than any degree of menace to the commerce and industry of this country from Russia. Realizing the appeal of money figures, they start their book with the statement that American exports to Russia have risen from practically nothing in 1923 to $139,000,000 in 1930, "making the Soviet Union the eighth best foreign market for American products." Imports from Russia to the United States are at a far lower figure and not of a kind to cause alarm here, the authors state. Besides a detailed analysis of the major commodities entering this country from Russia, the book contains chapters on Russian foreign trade in general, on "dumping," on labor conditions in Russia and on the Soviet "five-year-plan" in relation to foreign trade. In view of the large number of American engineers, contractors, manufacturers and merchants intimately concerned with Russian industry and trade the book deserves careful attention in this country.

Publications Received

MECHANICAL PROPERTIES OF ALASKA WOODS, with descriptions of methods and apparatus for tests of strength of wood, are given in an 80-page illustrated report by L. J. Markwardt (Technical Bulletin 226, free, from U. S. Department of Agriculture, Washington, D. C.).

WATER AND SEWAGE-TREATMENT PLANTS in Pennsylvania are listed and described in tables included in the *Year Book* of the Pennsylvania department of health for 1929 (Harrisburg, Pa.), besides which the work of the department's bureau of engineering for the year is reviewed. There are separate tables for water filtration, chlorination and softening plants and another one for sewage-works.

CONCRETE CRIB RETAINING-WALL construction is the subject of a report, with discussion, in the 1930 *Proceedings* of the American Railway Bridge and Building Association ($2 from C. A. Lichty, secretary, 319 North Waller Ave., Chicago). Masonry failures and repairs, the programming of railway bridge maintenance and the maintenance of tanks and turntables are other subjects in this volume.

STOKERS fed 81 per cent of the 42,000,000 tons of coal consumed in 1928 by the public utilities of the United States, according to a report on "Sources of Coal and Types of Stokers and Burners Used by Electric Public Utility Power Plants," by William Harvey Young, a joint study by the Institute of Economics in cooperation with the U. S. Geological Survey. Of the remainder, 17 per cent went to pulverized coal burners and 2 per cent to hand-fired boilers. By class, underfeed stokers were far in the lead, the chain grate came next and the overload handled but 3 per cent of the total coal consumed. Details of the use of stokers and of sources of coal are given by states in the bulletin. (Paper; pp. 79. 50c. from the Brookings Institution, Washington, D. C.)

PRIOR TO 1910 PHILADELPHIA and other large cities in the tri-state district grew faster than their environs. The 1930 census showed a dynamic suburban increase, much faster than that of the cities. This outward movement is the most emphatic argument for regional planning. Blighted areas are left in the wake of population and business shifts. Planning or replanning to insure stability of occupancy is necessary to eliminate the deteriorating effect these changes have upon the social and economic progress of the region as a whole. Thus is stated the Philadelphia regional problem in "Population Trends," a 32-pp. 8x11-in. pamphlet issued by the Regional Planning Federation of the Philadelphia Tri-State District, Fox Building, Philadelphia, Pa. Matters treated include rapidity of growth, intro-regional migrations, urban influences, trends in the dispersion of business, forethought necessary for physical facilities when the population doubles and, finally, plus, minus and stabilizing growth factors.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

THE AUTOBIOGRAPHY OF AN ENGINEER—By William Le Roy Emmet. Albany, New York: Fort Orange Press. Cloth; 6x9 in.; pp. 213; halftones. $2.

COMPRESSIVE TESTS OF JOINTED H-SECTION COLUMNS—By James H. Edwards, H. L. Whittemore, A. H. Stang. Reprint from Bureau of Standards *Journal of Research*, Feb., 1931. Paper; 6x9 in.; pp. 16; illustrated. 15c. from Superintendent of Documents, Washington, D. C.

CONTROL OF FLOODS ON THE PASSAIC RIVER: Special Report 2, Part I, New Jersey State Water Policy Commission, 605 Broad St., Newark, N. J. Paper; 6x9 in.; pp. 46; folding colored map.

DAILY RIVER STAGES at River Gage Stations on the Rivers of the United States, Vol. xxvii. By Montross W. Hayes, Principal Meteorologist. Paper; 9x11 in.; pp. 162. 50c. from Superintendent of Documents, Washington, D. C.

Aside from a few pages of notes, consists wholly of tables: (1) flood stages, and highest and lowest stages on various rivers, with dates and other data during periods for which records available; (2) daily stages in 1929 at 600 to 700 stations.

DER AUSGLEICH DES GEBIRGSDRUCKES IN GROBEN TEUFEN BEIM BERG- UND TUNNELBAU—By Dr.-Ing. Kurt Lenk. Berlin: Julius Springer. Paper; 7x10 in.; pp. 60; illustrations and tables. 4.8 rm.

ELASTIC ENERGY THEORY—By J. A. Van Den Broek, Ph.D., Professor of Engineering Mechanics, University of Michigan. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 260; many illustrations. $4.50.

FARM WATER POWER—By George M. Warren, Hydraulic Engineer. Farmer's Bulletin 1658, U. S. Department of Agriculture, Washington, D. C. Paper; 6x9 in.; pp. 22; illustrated. 10c. from Superintendent of Documents, Washington, D. C.

FIRE RESISTANCE IN BUILDINGS, Recommended Minimum Requirements: Report of the Department of Commerce Building Code Committee, William K. Hatt, Chairman. Cloth; 6x9 in.; pp. 58; 4 diagrams. 10c. from Superintendent of Documents, Washington, D. C.

FLOW OF LIQUIDS IN PIPES of Circular and Annular Cross-Sections—By Alonzo P. Kratz, Research Professor, Horace J. Macintire, Associate Professor, and Richard E. Gould, Research Associate, Engineering Experiment Station. Urbana, Ill.; University of Illinois. Paper; 6x9 in.; pp. 28; illustrated. 15c.

HIGHWAY ECONOMICS—By Sigvald Johannesson, M.Am.Soc. C.E., M.Inst.C.E., M.DanishSoc.ofC.E., Engineer of Design, New Jersey State Highway Department. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 157; line drawings and tables. $2.50.

LABORATORY STUDIES OF SLUDGE DIGESTION—By A. M. Buswell and S. L. Neave, Urbana, Ill.: State Water Survey. Cloth; 6x9 in.; pp. 84.

Summarizes five years' study resulting in the development of an accelerated process for the stabilization of waste matter described in Bulletin 28.

LAND DRAINAGE AND FLOOD PROTECTION—By Bernard A. Etcheverry, M.Am.Soc.C.E.; Consulting Engineer; Professor of Irrigation and Drainage, University of California. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 327; illustrations and tables. $3.

MAP DRAFTING AND LETTERING—By Howard Raymond Saunders, Assistant Civil Engineer, City of Los Angeles, and Howard Chapin Ives, Consulting Engineer. Los Angeles: Benson Book Co., Inc., 426 South Spring St. Cloth 6x9 in.; pp. 345; tables and illustrations. $5.

THE MECHANICAL PROPERTIES OF WOOD: Including a Discussion of the Factors Affecting the Mechanical Properties, Working Stresses for Structural Timber, and Methods of Timber Testing—By George A. Garratt, M.F., Assistant Professor of Forest Products, Yale University. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 275; line cuts and halftones. $3.50.

MODERN DIESEL ENGINE PRACTICE: A Comprehensive Treatise for the Student and Practical Engineer—By Orville Adams, Consulting Diesel Engineer. New York: The Norman W. Henley Publishing Co. Cloth; 6x10 in.; pp. 656; many illustrations. $6.

NATURAL TRIGONOMETRIC FUNCTIONS: To Seven Decimal Places for Every Ten Seconds of Arc Together With Miscellaneous Tables—By Howard Chapin Ives, C. E., New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth 7x10 in.; pp. 329; many tables. $9.

SIMPLIFIED CALCULATION OF STATICALLY INDETERMINATE BRIDGES: With appendix, Exact Theory of Three-Span Suspension Bridges—By G. G. Krivoshein, Mil. Eng., Civ. Eng.; Formerly Major General, Corps of Engineers of the Russian Empire, etc.; now Professor of the Technical Institute, Prague. Published in English by the Author, Bubenec, Buckova 27, Prague, Czechoslovakia. Also may be had in Czecho from Ceska matice technicka v Praze (Technical Publishing Society in Prague). Cloth; 7x10 in.; pp. 291; line cuts, pen-and-ink sketches and halftones. $5 postpaid for the edition in English.

STANDARDS YEARBOOK, 1931—Compiled by the National Bureau of Standards, George K. Burgess, Director. Cloth; 6x9 in.; pp. 399. $1 from Superintendent of Documents, Washington, D. C.

Gives information on standardization work of federal, state and municipal governments and of technical and trade associations.

THE STORY OF THE AIRSHIP—By Hugh Allen. Sixth annual issue. Akron, Ohio: Goodyear Tire & Rubber Co. Cloth; 6x9 in.; pp. 71; halftones.

STUDY OF INLAND WATERWAY SITUATION—By Samuel S. Wyer. Prepared for Fuel-Power-Transportation Educational Foundation, Beggs Building, Columbus, Ohio. Paper; 6x9 in.; pp. 32; diagrams. Free on application.

Apparently written from railway viewpoint. Contains interesting statistical summaries, reinforced by graphs.

THEORIE UND BAU VON TURBINEN-SCHNELLÄUFERN—Von Prof. Dr. Ing. Dr. Techn. H. C. Viktor Kaplan, Brünn, und Prof. Dr. Techn. Alfred Lechner, Wein. Munchen and Berlin: R. Oldenbourg. Cloth; 7x10 in.; pp. 301; many illustrations. 18 marks.

TREATMENT OF TANNERY WASTES: Processes found as the outcome of six years of study by the Tannery Waste Disposal Committee of Pennsylvania created by the agreement of 1924 between the Sanitary Water Board and Leather Tanning Companies. W. L. Stevenson, Chairman of the Committee and Chief Engineer, State Department of Health. Paper; 6x9 in.; pp. 38; illustrated.

Valuable summary of studies on treatment of tannery wastes, with recommended practice.

LETTERS TO THE EDITOR

Central American Highways

Sir—Various dispatches have appeared in the press during the past few days in regard to the proposed international highway from New York to Panama. One enthusiastic editorial refers to the "trucks which will trundle gayly from Laredo to the Gulf of Darien," giving "four centuries of history a new face." News items refer to the expenditures of $12,000,000 in Guatemala, $5,000,000 in Salvador, $10,000,000 in Nicaragua, etc., for their shares of this international highway. The chief engineer of Bureau of Public Roads of the United States seems to be one of the principal advocates of these expenditures and of the procession of trucks from Laredo to Darien.

It seems to the writer to be extremely bad policy for the United States government, or for the commercial bodies of the United States, to advocate uneconomical expenditures of money in Central America; and these proposed expenditures for an international highway surely fall in this class.

The national existence of all these countries depends upon the production and marketing of raw materials, coffee, sugar, henequen, minerals, etc. The markets are in Europe and the United States, and the roads to the markets must necessarily be from the interiors to the ports. Imported manufactured articles follow the same route in the opposite direction.

Inasmuch as the products of each country are very much the same and as their requirements of manufactured goods must be supplied from Europe or the United States, they have little or no commercial intercourse with each other; nor are they likely to have such in the future, whatever may be the development of rail, highway or air communication. Trucks will hardly find much business trucking steel beams, sewing machines, boots and shoes, typewriters or automobiles from Laredo to Mexico City even, to say nothing of Guatemala, Salvador or Managua.

The transportation strategy of all the countries of Central America is to develop and build lines of communication from the interiors to the nearest available harbor or port on the coast. There are large areas capable of producing wealth but with no means of reaching the markets where the produce can be turned into money or exchanged for things the people need.

Hundreds of miles of highways need to be built to develop the productive capacity of these countries, and it will take many millions of dollars to build them. In course of time these highways will reach the borders and permit communication by highway between the various countries, but this should be only a secondary consideration.

The United States, which prides itself (whether justly or not) on its commercial acumen, should advocate the construction of these highways or interior lines of communication that will develop the productive capacity of these countries, should lend them money to build them, and so help create and increase the market for its manufactures.

Even the automobile and motor truck people, were they guided by an enlightened policy, would see the wisdom of a policy of this kind, rather than that of encouraging any attempts for many years to come to build international or Pan-American highways.

FRED LAVIS,
President, International Railways of Central America.

New York, N. Y.,
March 23, 1931.

North Carolina's New Experiment

Sir—Having built a highway system that has merited the admiration of highway authorities of all countries, financed by a sound and equitable method of utilizing the proceeds of traffic taxes, North Carolina may find this system imperiled as a result of the recent road act discussed in *Engineering News-Record*, April 2, 1931, p. 548. Securing adequate funds for the completion of the hard-surfacing of the state highways is the most serious problem. About $35,000,000 will be required for this purpose. Without the additional burden of financing county road maintenance and with the assistance

received from the federal government, there would have been enough surplus from motor license fees and the gasoline tax, in all probability, to have completed the state highway system in a period of five years. What can now be done, with all local roads to be financed by the traffic taxes, is problematical.

Those who believe that local roads ought to be financed by traffic taxes point out that the total amount of these taxes will increase in proportion to the increase in the tax rate on each gallon of gasoline. If this is actually what will happen, then there will be a reasonable surplus from these taxes which may be used for state highway construction. But the revenue from gasoline taxes in North Carolina during the past several years has not increased in proportion to the increased tax rate.

Few states have been entirely successful in combining the maintenance of state and country roads. Local highway problems and politics naturally become involved in state highway problems. In North Carolina, under the new road act, petitions concerning county roads must first be considered by the board of county commissioners. The recommendation of the board then goes before the state highway commission. It may be that this arrangement will prevent many local road disputes from ever getting before the state highway commission. But it may be expected that, in the ordinary operation of the new system, there will be many purely local road disputes to be considered by the commission.

To summarize, North Carolina through its recent road act has: (1) Placed the entire burden of financing all classes of roads on traffic. (2) To do this it has increased the gasoline tax to a possible limit, beyond which any further increase will not bring in any greater total revenue. (3) It has placed the construction and maintenance of *all* county roads under the exclusive jurisdiction of the state highway commission. (4) It has, in effect, stopped all extended construction of any county roads. (5) Under this act, local road problems will now come up for consideration before the state highway commission. (6) The state highway commission will hereafter be the sole custodian of all county prisoners. (7) The state becomes definitely committed to the use of both state and county prisoners on all forms of highway work.

What will be the effect of these changes it is difficult to predict. Taking over the county roads is the outgrowth of a demand that taxes be reduced on property and that rural roads be improved. If these results can be accomplished without injuring North Carolina's splendid state highway system, then these radical departures from accepted methods are certainly justified. Much of the progress of the state during the past ten years is undoubtedly due to the rapid construction of good roads. It would seem to be absolutely necessary that nothing should be done that would, in any way, injure the value of this great transportation system to the economic needs of the state.

HARRY TUCKER,
Professor of Highway Engineering,
North Carolina State College.

Raleigh, N. C.,
April 4, 1931.

Multiple-Span Suspension Bridges

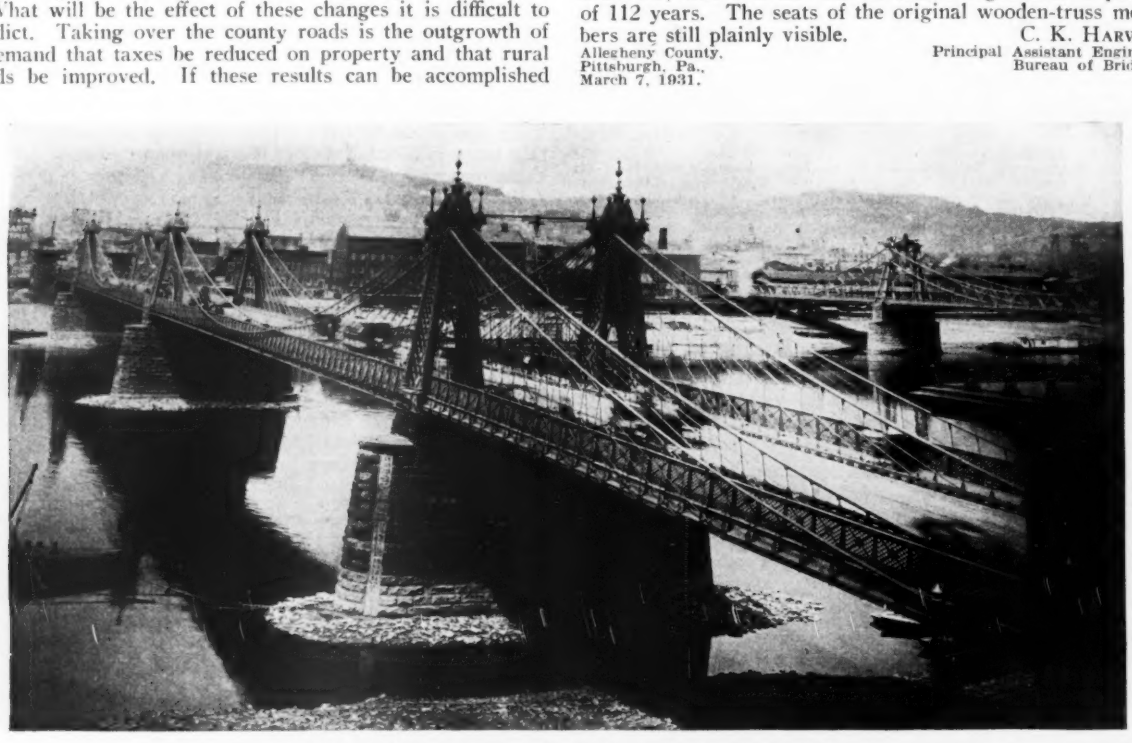
Sir—The editorial in your issue of Jan. 15, "Something New in Bridges," relating to multiple-span suspension bridges, suggested that your readers might be interested in the inclosed photograph of the two-span suspension bridge that carried traffic over the Allegheny River at Sixth St. in Pittsburgh for more than 30 years, until it was replaced in 1892 by two 439-ft. bowstring truss spans, designed by Theodore Cooper. The Cooper design was superseded in turn in 1928 by the present self-anchored eyebar suspension bridge, designed by the Allegheny County bureau of bridges, V. R. Covell, chief engineer. The Cooper spans were removed under our direction and transported practically intact to a new site 12 miles down the Ohio River at Coraopolis, where they now function as an important highway bridge from the mainland to the large Neville Island in the Ohio River.

The accompanying photograph is submitted merely as an interesting and beautiful example of a two-span suspension bridge designed and built more than 70 years ago, and not as having any direct bearing on the suggested use of horizontal tie cables in multiple-span design. A close examination of the photograph shows that horse cars were in use at the time the picture was made. It is probable that an inherent lack of rigidity in the structure became more noticeable with the advent of the heavier electric cars and resulted in its replacement.

The first bridge at this site was of the covered wooden type, built in 1819. It is interesting to note that some of the original masonry is still in use in the present north abutment, where it has served four bridges over a period of 112 years. The seats of the original wooden-truss members are still plainly visible.

C. K. HARVEY,
Principal Assistant Engineer,
Bureau of Bridges.

Allegheny County,
Pittsburgh, Pa.,
March 7, 1931.



Old multiple-span suspension bridge, Sixth St., Pittsburgh

Erected in 1860, this bridge was abandoned in 1892. The bridge in the background is the old braced eyebar chain bridge at Seventh St.

NEWS OF THE WEEK

Fire in Chicago Sewer Tunnel Costs Lives of Twelve Men

FIRE which broke out on Monday evening, April 13, in the 22d St. intercepting sewer tunnel now under construction for the Sanitary District of Chicago cost the lives of a dozen men, including workmen and firemen. Of undetermined origin, the fire was still burning Tuesday noon.

The concrete-lined tunnel is being built through soft clay with the invert 37 ft. below the street level. It is of horseshoe section 17 ft. high and 17 ft. wide. Only about 600 ft. has been completed of the 10,000-ft. contract let to the Ryan Company, of Chicago. Access to the tunnel is by a single shaft offset 30 ft. from the line of the sewer, connected to it by a monkey drift. Air locks are installed in the main tunnel on either side of the drift. Recent work has been done under compressed air at 5-lb. pressure to restrain the soft clay heading. Concrete bulkheads 2 ft. thick are keyed into the tunnel walls at each air lock. Sawdust was being used to seal the bulkheads against air leakage.

An uncomfirmed report is that a workman using a candle to search for leaks in the seal around the bulkhead set fire to the sawdust and the blaze spread to the timbering. In an attempt to subdue the blaze the contractor's men were overcome and the fire department was summoned to rescue them. The men who lost their lives were suffocated by the dense smoke or while engaged in rescuing those previously overcome. The rescue work was complicated by the necessity of maintaining air pressure on the headings, as it was feared that release would cause a cave-in and break a 30-in. gas main immediately over the tunnel. Finally this main was shut off and cleared. Early Tuesday morning sixteen men who had sought refuge in one of the locks were rescued.

Sultan Reports on Managua Earthquake

Reinforced-concrete and well-built stone buildings not destroyed and steel-frame cathedral, under construction, undamaged

THE Chief of Engineers, Major Gen. Lytle Brown, has received by mail from Lieut. Col. Dan I. Sultan, officer in charge of the Nicaraguan Canal Survey, now assisting in the relief work in Managua, the following report on the Nicaraguan earthquake, which is interesting from an engineering standpoint and from the standpoint of the effect such earthquakes may have on the proposed Nicaraguan Canal:

"*Description of Shock*—At 10:19 a.m. March 31, 1931, a slight tremor was felt in Managua, followed almost immediately by about ten distinct severe shocks. From the first tremor to the last shock one to two minutes elapsed. Mr. Frizell, of the Pan American Airways, states that he timed it and noted a total duration of two minutes, of which the shocks themselves took eight seconds. Several witnesses state that the vibration was from east to west, with practically no vertical motion. The amplitude of the earth waves was probably not more than a few inches, but the period of each shock was short.

"Following the main shock there were frequent minor tremors which have continued up to now (April 4) with diminishing frequency. Two of them were noticeably sharper than the others —one at about 9:15 p.m. March 31, and one early in the morning of April 2. Of these subsequent tremors, two or three were slightly perceptible in Granada, 26 miles to the southeast.

"*Area Affected*—The area affected was extremely limited. While the most severe shock was felt as far away as San Carlos and Rivas, no damage was done in any town other than Managua. No shock was felt in the vicinity of Greytown. The area of damaging effect was about 7 miles long in an east and west direction and 2 miles wide. The

HOTEL AND CABLEWAY PLANNED FOR MOUNT HOOD

Mount Hood, Ore., from the north side, showing features of the terrain involved in the Cascade Development Co.'s project to make the peak and surrounding country available by cable railway and aerial cableway. A large hotel is to be erected at a point just beyond where the men are standing. This is Cloud Cap, at El. 6,000, approximately. This hotel will be served by a cable railway from a point on the Mount Hood highway some 4½ miles distant. Continuing from Cloud Cap a second section of cable railway will extend about 3 miles to Cooper's Spur, El. 8,500, approximately, seen at the left in the view. From that point a single span of aerial cableway will extend to the summit, El. 11,225. Tentative approval by the department of agriculture has been given to the project as outlined. The cost of the project is estimated at $2,750,000. L. L. Tyler, Portland, Ore., is manager of the Cascade Development Co.

exact width of the area covered by serious shock is unknown, as it extended into Lake Managua.

"*Effects* — Reinforced-concrete or well-built stone buildings were not destroyed. However, their walls were cracked. They could be repaired at reasonable expense. There were no steel buildings in Managua, but a steel-frame cathedral was in process of construction. The frame was undamaged. Light wooden construction in the marine camp was only slightly damaged. The adobe houses in Nicaragua have comparatively thin walls (4 to 12 in. in thickness). In their centers are widely spaced studding supporting a lathing often of rounded sticks or of barbed wire. Their roofs are of tile, supported on round sticks resembling bamboo, under which is a widely spaced rafter system with very infrequent tension ties. Except in the cases of the newest and best structures this type of construction usually failed by collapse of both roof and wall, either in whole or part. A very poorly constructed concrete cemetery wall 5 ft. high, 8 in. thick and 150 yd. long was completely destroyed. Many poorly constructed stone gate arches were destroyed.

Without the fire the city would not have been destroyed and the loss of life would have been much less, although the damage would still have been enormous. A modern city of reinforced-concrete or steel buildings and wooden frame residences would have remained standing with reparable damage and the loss of life would have been small. There were some landslides in the vicinity of Lake Tiscapa and Lake Asososca, all of them on very steep slopes. Surface cracks have been discovered in a number of places. As a rule these cover a zone not over 300 ft. in length by 20 ft. wide. They run in a general north-south direction. The cracks are about 1 to 2 in. wide. The vertical displacement is less than 2 in. Pavements were broken in only a few isolated points. A cast-iron pipe line was pulled apart at one joint for a distance of about 2 in.

"*Cause*—This earthquake was not due to a volcanic explosion but was due to a local readjustment of underground strata. At the time of the shock Major Mitchell, the commanding officer of the U. S. Marine Aviation in Nicaragua, was flying in the vicinity of Momotombo, the nearest volcano to Managua showing any signs of activity. (Momotombo is a quiescent volcano.) He states that the volcano showed no signs of unusual activity. None of the other old craters in Nicaragua have shown any signs of unusual activity.

"*Conclusions*—This earthquake was caused by a local displacement of underground strata. The direction of the fault line was approximately north and south. The earthquake was severe over a small area only, but the maximum intensity of the disturbance was centered in the heart of the city of Managua. No damage whatever would have resulted to a canal line along the line Brito-San Carlos-Greytown."

Contract Awarded for Section of Philadelphia Subway

Bids for the construction of a section of the South St. subway in Philadelphia were opened on April 7, and on April 13 the contract was awarded to the low bidders, Jafolla & Marks, of Philadelphia, whose bid was $3,885,628.50. The section of the subway contracted for extends from south of South St. to south of Snyder Ave., and includes 7,285 lin.ft. of two-track subway, three passenger stations of the island platform type and an underpass for future tracks at Passyunk Ave.

Pennsylvania R.R. Construction Work to Be Pushed

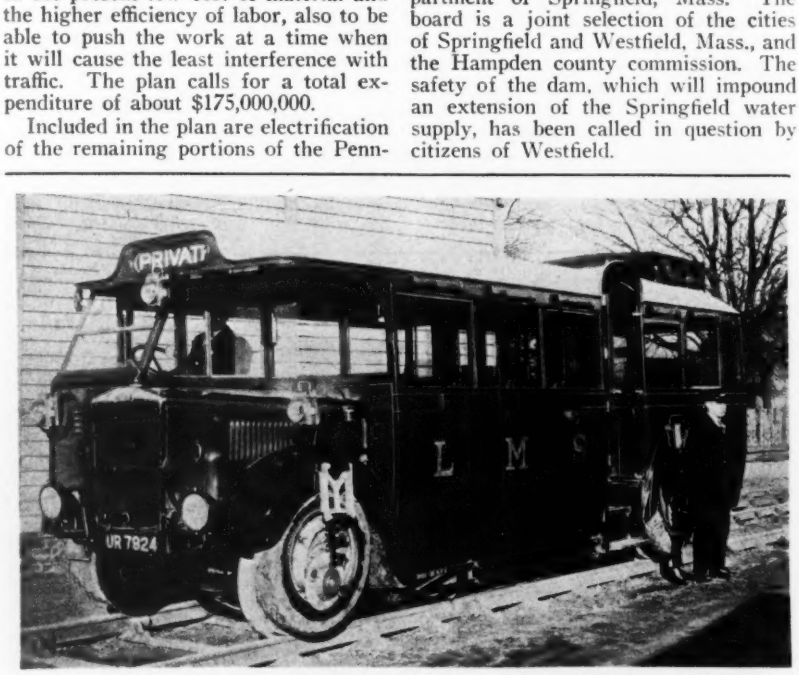
Plans for speeding up the construction projects of the Pennsylvania Railroad, tentatively announced by W. W. Atterbury, president, some weeks ago, have been outlined in more detail by General Atterbury in his annual report. The company's construction program, which as first laid down would not be completed until four years from now, has been altered to make completion of the work possible in about 2½ years. This has been done in order to take advantage of the present low cost of material and the higher efficiency of labor, also to be able to push the work at a time when it will cause the least interference with traffic. The plan calls for a total expenditure of about $175,000,000.

Included in the plan are electrification of the remaining portions of the Pennsylvania lines between New York and Washington; completion of the new 30th St. station at Philadelphia; completion of the terminal improvements at Newark, N. J., including a new station and the building of bridges over the Passaic River; six-tracking of the Pennsylvania main line through Elizabeth, N. J.; construction of a new line around Trenton, N. J., including completion of a new bridge over the Delaware River which was begun some years ago; and reconstruction of the Pennsylvania Terminal in Baltimore, Md., including the removal of numerous grade crossings and the building of two new double-track tunnels.

Contracts for upward of 100,000 tons of steel were let by the railroad company late in March, about half of which is for the electrification work. The contract for the excavation and foundation work for the new passenger terminal at Philadelphia was let recently.

Engineers Named to Examine Cobble Mountain Dam

J. Waldo Smith, of New York, and Charles T. Main and X. H. Goodnough, of Boston, have been named as a commission to pass upon the safety of the Cobble Mountain Dam, of the water department of Springfield, Mass. The board is a joint selection of the cities of Springfield and Westfield, Mass., and the Hampden county commission. The safety of the dam, which will impound an extension of the Springfield water supply, has been called in question by citizens of Westfield.



RAIL AND ROAD TRANSPORTATION COMBINED IN SINGLE VEHICLE

Highway or railroad can be used at will by this unusual vehicle, which has been built for the L.M.S. Railway of England by Karrier Motors, Ltd., of Huddersfield. Equipment on this 26-passenger bus model includes a 120-hp. motor, special transmission, lights conforming to highway and railroad requirements and a track-sanding device. Flanged wheels are mounted on the axles, outside of which are hung larger pneumatic-tired road wheels. On the highway both sets are concentric, but on rails the outer wheels are raised above rail level and do not revolve. The change-over requires from 2½ to 5 minutes, but no special tools or equipment. All that is necessary is a short piece of track where the ground is level with the top of rail. Vehicles of this type are also planned for the transportation of freight. They are particularly suitable for branch-line use and are expected to find ready acceptance for the transportation of railway repair and maintenance gangs, since they are easily removed from and replaced on the rails.

Paris, Ky., Enters Municipal Water-Works Field

Litigation of several years between the city of Paris, Ky., and the Paris Water Works Co., now in the hands of a receiver, has ended by an agreement that the city take over the company's properties, franchise and good will for a payment of $168,000. The city will take title about May 1.

A bond issue of $300,000 will take care of the financial end of the transaction and the balance left after paying the company will be spent for improvements. Plans for improvement call for building a new filtration plant costing about $32,000, new pumping equipment valued at $18,000, expenditure of $26,000 to improve the distribution system, $32,500 for installing meters on the entire system, and $15,000 for rebuilding the Spears Mill Dam for impounding an emergency water supply.

Court to Reconsider Ohio Bond Issue Case May 13

The Ohio supreme court has set May 13 as the date for rehearing the Allen County sewer and water bond case, in which the decision of the court was that the issuance of improvement bonds assessable against entire taxing districts for the specific benefit of subdivisions thereof are illegal. The validity of many municipal issues was placed in question by the decision, which was noted in *Engineering News-Record*, March 12, p. 457. Practically all interested bodies in the state have submitted briefs, and the large amount of material to be reviewed by the court is expected to delay decision for some time.

New York to Assume Control of Private Water Companies

Just before its final adjournment on April 10 the New York legislature passed a bill amending the public service law to bring all private water companies under the jurisdiction of the Public Service Commission. The bill was amended by striking out all reference to municipally owned water companies.

As Governor Roosevelt had earlier in the day sent an emergency message to the legislature urging passage of the bill, he is expected to sign it.

Extra Compensation Allowed for Diablo Dam Construction

The board of public works of Seattle, Wash., has recommended to the city council that the Winston Brothers Co. be allowed $303,005.32 as extra compensation for building the Diablo Dam on the Skagit River for the city light department. This settlement of the contractors' claim for $608,969.65 for work not covered by the contract would bring the total cost of the dam to $4,877,500, of which the Winston company would receive $3,977,500, the balance representing cost of machinery, engineering expenses and other extras. The proposed compromise provides that the city shall withdraw its counterclaim for $419,600 for failure to complete the work within the specified time.

Additional excavation and much heavier construction on the dam than was provided in the original estimate caused the bill for extras. City Engineer R. H. Thomson explains that much of this additional work was demanded by federal engineers upon failure of the St. Francis Dam.

Civil Engineers' Board Acts on Engineer-Architect Report and Bridge Clearances

Proposed segregation of structural engineers not approved—Study of a rational method of determining bridge clearances authorized—Disadvantages of Russian contract engineering work outlined

THE MEETING of the board of direction of the American Society of Civil Engineers at Norfolk, Va., April 13-14 was characterized by definite action on three matters of commanding interest — namely, engineering practice in the building field, the American engineer in Russia, and bridge clearances over navigable waters. In the way of other accomplishments the board broadened the field for the Rudolph Hering medal, awarded for a paper on sanitary engineering subjects, to include any original paper submitted to the society rather than only a paper published in *Transactions* as heretofore. It accepted a civil engineering scholarship at Columbia open to graduates and undergraduates to be known as the Horatio Allen scholarship after the fifth president of the society; and it took the recommended action on four cases submitted to it by the professional conduct committee. Twenty-four of the 26 members of the board were present.

Engineering practice in the building field, and the related subject of licensing, was dealt with in three actions. The board indorsed the amendment to the New York state registration law, recently passed by the legislature, which raised the qualifications necessary for registration under the law, and the amendment to the multiple dwelling law, which restored to engineers the right to file plans under that act. Secretary Seabury was authorized to wire Governor Roosevelt urging his signature to the amendments. At the same time the board disapproved the joint engineer-architect report on the subject of needed legislation on the ground that the suggested segregation of engineers into a "professional engineer structural" grade was undesirable as likely to lead to jurisdictional disputes among engineers.

A resolution was passed urging that members of licensing boards in the various states be picked from lists of candidates preferred by local or national engineering societies to the end that these boards be non-partisan in nature and competent technically.

The newly formed engineering economics division of the society was urged in a recommendation to undertake a study of bridge clearances over navigable waters. The study as outlined was planned with three objectives: to determine the economic factors affecting vertical and horizontal clearances, giving due weight to the rights of both water and land transport; to fix rational high water stages from which clearances should be figured; and to evaluate the economic factors from the viewpoint of navigation interests that determine whether or not a stream should be classed as navigable.

The American engineer in Russia was the subject of a committee report accepted by the board for publication. Briefly the report sets forth food, hospital, clothing, money and similar conditions that prevail in Russia and points out that the environment is one that requires a man having a distinct predilection toward pioneering. It stresses the lack of social advantages and the difficulties of companionship with the Russian engineer, who works under a constant threat of severe punishment for any shortcomings. The Amtorg contract with American engineers is found to be substantially the same as that required by American engineering firms doing business in foreign countries. An important conclusion is that while American engineers and engineering firms enjoy a good standing in Russia now there is no assurance that this attitude will continue and there is in fact some evidence that this standing is not as good as it once was. The committee making the report consisted of Philip W. Henry, chairman; R. W. Hebard, George W. Kittredge, George H. Pegram, and John R. Slattery.

Floodlighting facilitates night work on Owyhee Dam in Oregon

License Bills Fail to Pass in Washington and Oregon

A bill to regulate the practice of professional engineering and survey in the State of Washington was vetoed by the governor on March 21. The governor in his veto message said:

This is a lengthy, complicated and technical bill for the regulation of the profession of engineering, embracing "investigating, reporting on, designing and/or supervising the construction of equipment, structures, utilities and/or projects, when the proper performance of such services requires technical engineering knowledge and skill, and shall include civil, mechanical, structural and/or hydraulic engineering," and land surveying. It would create another board. If the necessity for such a law were admitted, the provisions of the present bill are objectionable for their drastic and far-reaching effects.

In Oregon a bill to amend the license law in order to improve the definition of the practice of engineering was killed in the state senate. The definition of the practice of engineering as given in the Oregon law enumerates in detail the various operations carried on by engineers. The amendment was to add operations not specifically mentioned in the existing law.

School Bond Issue and Charter Amendment Lose in St. Paul

A school bond issue and an amendment to the city charter were defeated by the voters of St. Paul, Minn., on April 7, the vote being 23,226 against and 13,622 for. The two propositions were linked as one, and only 36,848 out of the 95,041 registered voters appeared at the polls. The bond issue provided $975,000 for new buildings and additions to the schools. The charter amendment added $1 per capita to the $30 limitation, the extra amount to be spent annually for new school buildings, sites and equipment.

Southeastern Section, A.W.W.A., in Annual Convention

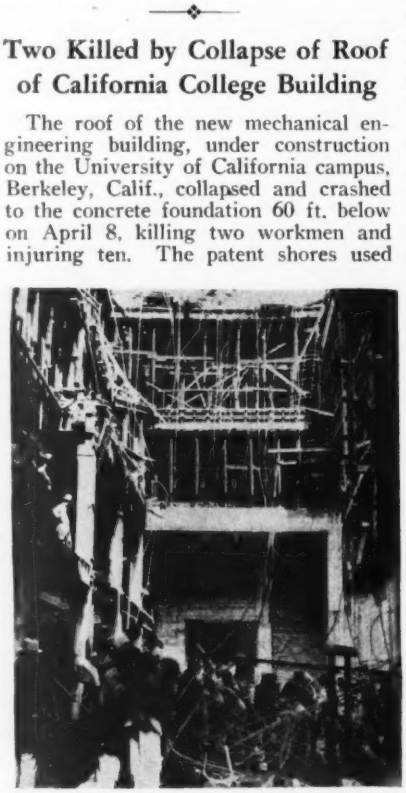
More than 200 attended the annual convention of the Southeastern section of the American Water Works Association in Columbia, S. C., April 7, 8 and 9. Among the addresses and papers read were the following: Informal talk on the work of the organization, by Beckman C. Little, secretary of the national association; address by George H. Fenkell, president of the American Water Works Association and superintendent of the water department of Detroit; "Plankton and Public Water Supply," Prof. Hugh A. Wyckoff, Georgia School of Technology; "The Use of Algæcides," J. H. Marquis, superintendent of filtration of the waterworks department, Spartanburg, S. C.; "Observations on Taste and Odor," A. J. Smalshaf, superintendent of filtration at Columbus, Ga.; "Ammonia-Chlorine Treatment of Water," Dr. J. F. H. Berlinger, of the National Ammonia Co., Wilmington, Del.; "Economics of the Selection and Operation of Centrifugal Pumps," Roland B. Hall, Atlanta; "Some Problems of Groundwater in the Southeastern States," David G. Thompson, geologist for the U. S. Geological Survey; "Water Softening," George Bacon, Philadelphia; "Observations on Water Treatment at Atlanta," Paul L. Weir, and "Stream Pollution and Sewage-Treatment Methods," J. M. Henderson, assistant sanitary engineer of the Georgia state board of health.

After luncheon on the first day an inspection tour of the Saluda hydroelectric development was made.

Guy H. White, superintendent of the Columbia water-works department, was elected chairman for the coming year, succeeding H. F. Wiedeman, of Atlanta, Ga. H. P. Powell, of Griffin, Ga., was elected vice-chairman. The convention city for 1933 was not named.

Two Killed by Collapse of Roof of California College Building

The roof of the new mechanical engineering building, under construction on the University of California campus, Berkeley, Calif., collapsed and crashed to the concrete foundation 60 ft. below on April 8, killing two workmen and injuring ten. The patent shores used to hold up the roof forms gave way, but what caused them to collapse has not been determined. According to the state industrial accident commission, the work was inspected by a state inspector three hours previous to the accident, at which time no concrete had been poured. The accident occurred after the pouring of concrete had been started.



Part of University of California building where collapse occurred

An investigation is being made to determine the cause of the collapse, the interested parties being the state, the University of California, Berkeley city authorities, and Barrett & Hilp, contractors, who are erecting the building.

Two Large Suspension Bridges for Shelter Island, N. Y.

The approval of a $5,000,000 bond issue by the board of supervisors, Suffolk County, New York, apparently insures the construction of three new bridges, including two major structures of suspension design, on a new highway route between Greenport and Sag Harbor, located on opposite sides of Peconic Bay, near the northeastern tip of Long Island. The highway crosses Shelter Island, situated in the entrance to the bay from Long Island Sound. The new suspension bridges will connect this island with the mainland.

The bridge between Shelter Island and Sag Harbor will be about 3,000 ft. long, have a main span of 700 ft. and a clearance of 95 ft., and will cost about $1,100,000. The bridge connecting the island with Greenport will be about 4,000 ft. long, have a main span of 1,100 ft. and a clearance height of 135 ft., and will cost about $1,900,000. Both bridges will have 20-ft. roadways, with a 4-ft. sidewalk on each side. The third bridge will be of double-leaf bascule type, estimated to cost about $350,000.

It has been proposed but not yet decided that tolls will be charged for use of the bridges. The bond issue, however, is a county obligation and will not be secured in any way by revenue from the bridges. Robinson & Steinman, consulting engineers, New York City, are the designing engineers. According to this firm, borings have been under way for some time and plans are nearing completion so that substructure bids can be asked some time in May. For the suspension bridges, alternate designs permitting parallel wire rope strand cables are being prepared.

$5,000,000 Central Heating Plant for Washington, D. C.

Secretary of the Treasury Mellon has announced the selection of the United Engineers & Constructors, Inc., of Philadelphia, Pa., for the design, working drawings, specifications and supervision of the proposed central heating plant in Washington, D. C.

The plant, which will cost approximately $5,000,000, has been under consideration for some years and the decision to build it at this time has been reached because of the requirements for supplying heat and power to the new government buildings recently completed, now under construction or contemplated in the district known as the Triangle, bounded by Pennsylvania Ave., Maryland Ave. and Fifteenth St. It is planned ultimately to furnish steam for 26 buildings, which in an average year will consume approximately 1,500,000,000 lb. of steam. The present installation will be about 25 per cent less, and the future increases in demand will be taken care of by extending the plant. Steam will be distributed to the buildings through pipes varying in diameter from 3 to 18 in. and having an aggregate length of about 5 miles.

Ricker Made Consultant to Planning Commission

George A. Ricker, for many years Washington representative of the Portland Cement Association, has been appointed industrial consultant to the National Capital Park and Planning Commission, which is taking an important part in planning the development of the city of Washington and surrounding areas in Maryland and Virginia. While it has been the policy of Congress to discourage industrial development in the Washington area, there are certain industrial activities which are essential to the community. With the growth of the city this has presented a problem of increasing difficulty. To meet that situation an industrial consultant has been retained by the commission.

Mr. Ricker was for many years engaged in railroad engineering work. He was in charge of the construction of the Niagara Gorge Railroad and the lines of the Buffalo Traction Co. He was resident engineer of the Buffalo Creek Railroad and planned many of the industrial terminals in the Buffalo harbor district. He was the first deputy commissioner of highways for New York State. He resigned that position in 1915 to become Washington representative of the Portland Cement Association.

Federal-Aid Highway Contracts Show Great Increase

Federal-aid highway contracts let in March were nearly four times greater in value than those let in the same month last year, according to Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads. The value of the contracts let last month was $52,356,395.24, and of those let in March, 1930, was $13,108,763.46, showing an increase of $39,247,631.78. In addition to highway contracts, $1,860,197.32 worth of federal forestry project contracts and $81,300.04 worth of federal park project contracts were awarded in March of this year.

Consulting Service on Steel Castings Offered Designers

Announcement is made by the Steel Founders' Society of America, Inc., that it has established an engineering department under the direction of an experienced metallurgist and engineer to provide consulting service to mechanical engineers, designers and others engaged in the selection and application of metals for products of all kinds. This service is offered without charge by the society, which is made up of a group of steel foundry organizations. W. H. Worrilow, Lebanon Steel Foundry, Lebanon, Pa., is president; vice-presidents include G. R. Casey, Treadwell Engineering Co., Easton, Pa.; W. W. Powell, Mesta Machine Co., Pittsburgh, Pa.; Arthur Simonson, Falk Corporation, Milwaukee, Wis., and Burtner Fleeger, Oklahoma Steel Castings Co., Tulsa, Okla.

Indicative of the type of service the engineering department will render is assistance with such problems as: (1) proper apportioning of metal sections for best casting results; (2) advice concerning types of cast steels available to satisfy desired physical specifications; (3) redesign of cast-steel members with which trouble has been experienced either in production or service; (4) redesign of products previously constructed in metals other than cast steel; (5) locating a foundry capable of handling individual requirements.

Inquiries should be addressed to the development engineering department, Steel Founders' Society of America, Inc., 420 Lexington Ave., New York, N. Y., according to Granville P. Rogers, managing director of the society.

Road Builders to Meet in Washington May 15

The annual meeting of the American Road Builders' Association will be held in Washington, D. C., on May 15. Meetings of old and incoming boards of directors of the national association and the various divisions will be held on May 14 and 16.

Plans will be perfected at these meetings for the work of the coming year. Among the subjects to be discussed are the appointment of joint cooperating committees with the American Association of State Highway Officials and the Highway Research Board, and appointment of the chairmen of more than a score of committees that will engage in the investigative work of the year. Results of committee work during the past year will be reviewed and new subjects for committee work examined and approved. Meetings of the old and incoming boards of directors of the county and boards of directors of the county and city divisions will be held and the various executive committees will also meet and plan their work.

The Business Outlook

Business continues to crawl along the astonishingly flat trough that has lasted more than four months. Week to week and even month to month movements are slight, sporadic, still unsignificant. Steel activity slides off more swiftly from its feeble spring peak, with increasing price uncertainty but with persistent hope of improved demand later from summer construction contracts. Our adjusted index of business activity moved downward to 79.8 per cent of normal for the first week of April, compared with a revised figure of 81.3 per cent the preceding week and 96 per cent a year ago. Building alone evidences any vigor, but mainly with support of public money.

The Business Week, April 15.

WASHINGTON NOTES

By PAUL WOOTON
Washington Correspondent

New Orleans and Baton Rouge in Rivalry for Bridge—Contract Let for Hydraulic Laboratory

KEEN rivalry is displayed by New Orleans and Baton Rouge to secure the first bridge across the lower Mississippi. Money for the construction of a bridge at New Orleans has been available for a year. All necessary permits have been secured, but difficulties have been encountered in persuading the railroads to use the bridge instead of ferries. The Texas & Pacific and the Missouri Pacific railroads prefer to make the crossing at Baton Rouge. Terms satisfactory to the Southern Pacific have not been arranged but are in their final stages. Unless a considerable portion of the annual revenue can be secured from railroads, the cost of the New Orleans bridge, which must have a vertical clearance of 137 ft., is regarded as prohibitive.

The Louisiana highway commission has agreed to pay $2,500,000 of the cost of the proposed bridge at Baton Rouge, authorization for which has not yet been obtained. Other interests have announced their willingness to go ahead with the project, but the plan contemplates a vertical clearance of 65 ft. and a bridge of that height is expected to cost $7,000,000. Missouri Pacific officials were in Washington last week and conferred with Major Gen. Lytle Brown, Chief of Engineers. While General Brown would not say in advance of the hearing to be held in New Orleans May 27, or until a special study of the situation had been made, what clearance would be required, it is understood that he favors a clearance of at least 112 ft.

Hydraulic Laboratory Contract Awarded

After an analysis of the bids received on the second advertisement for the construction of a hydraulic laboratory building at the Bureau of Standards, the contract was awarded to Stofflet & Tillotson, of Philadelphia, on April 7 for $294,887. In order to expedite construction, work will be started ten days after the signing of the contract. The time for completion is 330 days.

The original bids were opened on March 23, when Stofflet & Tillotson were the low bidders, for $303,900. Because there was an error in the two low basic bids, it was decided to readvertise. Stofflet & Tillotson's bid the second time was $298,987, with an alternate bid of $294,887, and on the latter bid they were awarded the contract. As the entire appropriation authorized for construction of the building and purchase of equipment is $350,000, it will now be possible to obtain the necessary equipment within the amount authorized in the appropriation.

The six other bids opened on April

7 were as follows: W. P. Rose Construction Co., Washington, $298,400; George E. Wyne, Washington, $300,000; Arthur L. Smith Co., Washington, $307,000; Maitico Construction Co., Washington, $307,489; Loundoun & Rust, Washington, $309,705; Turner Construction Co., Buffalo, $324,600.

Observation Well Shows Rise in Groundwater Level

By means of its observation well near Washington, the Geological Survey has detected a rise in the groundwater level for the first time in nearly a year. While the observation well near Washington shows in detail the conditions only in its vicinity, it has a general significance for the entire region affected by the drought. The automatic recorder in the well, which has been in operation for the last two years, showed a rise of 2 in. in the water level between March 28 and April 4. The water level on March 28 was nearly 3 ft. lower than for the same period last year.

Power Company Loses Tax Appeal

The right of the State of Maryland to assess taxes on land submerged by the construction of the Conowingo dam across the Susquehanna River was upheld by the U. S. Supreme Court on April 13 in the case of the Susquehanna Power Co. versus the State Tax Commission of Maryland. The court affirmed the decision of the lower court, which held that the state was within its authority in assessing the 2,110 acres submerged by the dam and in requiring the payment of a tax. The power company contended that in operating its power plant under a license issued by the Federal Power Commission it became in effect an instrumentality of the national government and could not constitutionally be subjected to state taxation.

To Appeal New River Decision

There is reason to believe that the Appalachian Electric Power Co. will appeal to the courts the decision of the Federal Power Commission in the New River case. Chairman Carson of the Virginia Conservation and Development Commission, characterizes the commission's decision as a "wallop" to Virginia. Southern newspapers see in the decision an encroachment upon the rights of the states and express regret that large employment has been prevented by the action of the commission.

Concrete Pavement Yardage

Below is given a tabulation of the concrete pavement awards in the United States for the month of March, 1931, classified according to roads, streets and alleys.

	Yardage Awarded During March, 1931	Yardage Awarded to Date as of March 28, 1931
Roads	17,572,871	35,112,165
Streets	1,819,282	3,720,162
Alleys	74,415	144,543
Total	19,466,568	38,976,870

Brief News

HIGHWAY BEAUTIFICATION is provided for in a bill signed by Governor Larson, of New Jersey. Each year 1 per cent of the previous year's expenditures for highways will be set aside in a special fund for the purpose.

THE NOMINATION of Edward A. Duffy, of Seattle, Wash., president of Reitze, Storey & Duffy, consulting engineers, by Mayor Edwards to the position of superintendent of city light, succeeding J. D. Ross, recently dismissed by the mayor, has been rejected by the city council. This is the third nomination to the position by the mayor to be rejected by the council.

PLANS FOR ELECTRIFICATION of all railways in Norway during the next five years have been submitted to the parliament of that country. In pursuance of the plan the government intends to construct three new hydroelectric power plants.

BIDS FOR SEWERS in Queens County, New York City, opened recently, provide evidence of the prevailing low cost of materials. The engineers' estimate of the fourteen contracts was $607,414.84, whereas the total of the low bids on the contracts was $434,071.15.

RECONSTRUCTION and repairs to the water system of Helena, Mont., are assured by a decision of the state supreme court validating Helena's $200,000 bond issue, the court holding that the legislature has cured defects in previous procedure.

TOLL ROADS in the United States amount to less than 150 miles, according to the report submitted to the U. S. Bureau of Roads by H. H. Kelly, division of highway transport. In 35 states there are no toll roads of any character. In the public road system of the United States there are 3,000,000 miles.

VOTERS of Oakland, Calif., by a vote of more than 3 to 1, have rejected a proposed new charter, thereby automatically approving the council manager form of city government, adopted at the election last November. A city manager will be engaged by majority vote of the city council.

PROLONGED NEGOTIATIONS among continental cement producers for the establishment of new international standards for portland, ferro-portland, bauxite and artificial cement have resulted in a preliminary agreement which will be laid before a commission composed of representatives of seven European nations. If agreed to, the standards will be proclaimed as international standards.

SOCIETY CALENDAR

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; 34th annual meeting, Chicago, June 22-26.

AMERICAN WATER WORKS ASSOCIATION, New York; annual convention, Pittsburgh, Pa., May 25-29.

AMERICAN WELDING SOCIETY, New York; annual meeting, New York City, April 22-24.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA—A meeting of the executive board, advisory board, president's council and secretary's council will be held in Washington May 8 and 9.

ILLINOIS SECTION, American Water Works Association, will hold its 23d annual convention April 28-29 in Bloomington. An interesting program has been provided.

MASSACHUSETTS CHAPTER, American Society of Heating and Ventilating Engineers, will hold its semi-annual meeting at Swampscott, Mass., June 22-26. Leslie Clough, 80 Boylston St., Boston, Mass., is secretary.

MID-SOUTH SECTION, American Society of Civil Engineers, will hold its second annual meeting in Memphis, Tenn., on April 30 and May 1. Talks will be made by Francis Lee Stuart and George B. Seabury, president and secretary, respectively, of the parent society; by Major Brehon B. Somervell, Corps of Engineers, on "Some Engineer Problems in the National Capital,"; by J. F. Coleman, of New Orleans, on "The American Society of Civil Engineers"; by Thomas H. Allen, of Memphis, on "The New Sheehan Pumping Station"; by T. T. Knappen, area engineer, Corps of Engineers, on "Flood-Control Work in the Vicinity of Cairo"; and by Kenneth Markwall, engineer for the Memphis Harbor Commission, on "Memphis Harbor."

NATIONAL FIRE PROTECTION ASSOCIATION will hold its 35th annual meeting in Toronto May 11-14. This year's convention will be the first held in Canada since 1919, when the association met in Ottowa. Much of the time of the meeting will be devoted to action on more than a score of technical reports embodying revised standards for the control of specific fire hazards and new methods of fire extinguishment.

NEW ENGLAND WATER WORKS ASSOCIATION will hold a luncheon meeting on April 28 in New Haven. Before the meeting a trip will be made in buses to Lake Gaillard, the New Haven Water Co.'s storage reservoir. After luncheon Edward E. Minor, manager of the company, will show pictures describing this undertaking and also forestry work now being carried on by the company.

TEXAS SECTION, Society for the Promotion of Engineering Education, has been organized, with F. E. Giesecke, director of the engineering experiment station, Texas A. & M. College, as president. Other officers are: vice-president, W. J. Miller, dean, Texas Technological College; secretary-treasurer, J. A. Correll, University of Texas.

Obituary

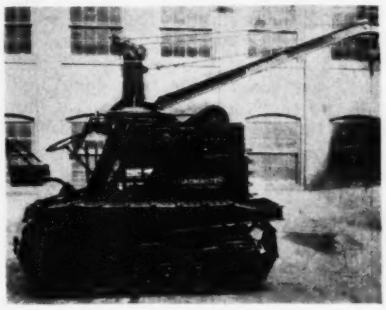
PETER J. BECKER, engineer for the Colorado state highway department, with headquarters in Colorado Springs, died in Glenwood Springs of a sudden heart attack on March 31.

H. B. KIRKLAND, civil engineer and at one time prominent in the development and use of pneumatic concrete-placing for tunnel lining and other purposes, died at Evanston, Ill., on April 3. He was born at Bartlett, Ill., in 1881, and after being graduated at the University of Wisconsin he had a varied career on railroad work in this country and in South America. During the World War he became a captain in the construction division of the U. S. Army. In recent years he was editor of *Railway Purchases and Stores*. Mr. Kirkland was a member of the Western Society of Engineers.

Construction Equipment and Materials

Bucyrus-Erie Co. Acquires Loadmaster Crane

Manufacture and sale of the Loadmaster revolving boom crane, formerly sold by Frederic H. Poor, Inc., New York City, have been taken over by the Bucyrus-Erie Co., of South Milwaukee, Wis., it is announced. This



Revolving boom crane

mobile crane, with a boom swing of 360 deg., has a rated capacity of 3,500 lb., although much heavier loads can be handled under special conditions, and has a maximum working reach of 14 to 16 ft. The machine may be mounted either on crawlers or on rubber-tired wheels, in the latter case having a maximum traveling speed of approximately 11 miles an hour. It can be used as a stationary revolving boom crane, as a crane traveling with its load, or as a tractor. A wide field of usefulness is claimed for this crane on account of its extreme mobility and ease of handling, especially in the field of public utilities, railroads, pipe-line construction, shipyards, foundation or construction work, airports and seaplane bases.

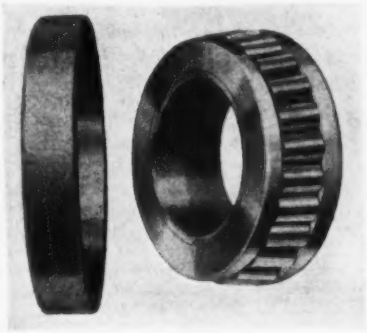
Trailer Transports Shovels

Developed primarily for the rapid transportation of Bay City tractor shovels and revolving shovels, a four-wheel trailer with a capacity of 50 tons which has been announced by the Bay City Shovels, Inc., Bay City, Mich., can also be used for moving other contractors' equipment weighing up to 14 tons. The trailer consists of an electric welded frame made up of 12-in. steel ship channels and steel wheels equipped with Timken bearings and 28x12-in. solid rubber tires. The outfit has a wheel base of 15 ft. 1 in. and an over-all width of 8 ft., making its use permissible on all state highways without special permit. Approximate loading time for a Bay City shovel is given as approximately eight minutes.

Cageless Roller Bearings

Convinced that roller bearings have not satisfactorily met all requirements of present-day engineering, the Tyson Roller Bearing Corp., Massillon, Ohio, offers a complete line of cageless tapered roller bearings interchangeable with conventional ball and tapered roller bearings.

Absence of a cage or retaining ring is the principal feature of the Tyson tapered bearing. Positive roll alignment is attained by the use of a double-ribbed backplate at the big end of the rolls, thus doing away with the necessity for a cage. The shoulder of each roll gets a bearing on the inside rib of the backplate, as in other conventional tapered roller bearings, but it also gets an additional bearing on the outside rib, an exclusive feature. Thus, with double



Roller bearing with cup removed

contact on the thrust end of each roll, positive alignment both longitudinally and vertically is secured. Pintles at both ends of the rolls, extending into annular grooves in the backplate and closing ring, hold the rolls in place when the cup is removed. The pintles and grooves have no other function.

Omission of the cage leaves room for from 20 to 50 per cent more rolls than in roller bearings of corresponding sizes with rolls spaced apart. The result, the company claims, is substantially greater load-carrying capacity for a given size, increased durability, less maintenance cost and less bearing friction resistance.

15-ton trailer for transporting contractors' equipment

Oil-Type Air Cleaner Activated by Exhaust Connection

Utilization of exhaust gases as a means of operation is a distinctive feature incorporated in the United Imperial air cleaner recently developed by the United Air Cleaner Corp., 9705 Cottage Grove Ave., Chicago, Ill., and designed especially for the protection of internal-combustion engines exposed to severe dust and dirt conditions. A complete range of models is made for application to various sizes of engines.

As shown by the illustration, the new cleaner is of the oil type, a removable

Cut-away section of air cleaner

compartment at the bottom being provided for the oil reservoir. Immersed in the oil is a short section of slotted pipe which is connected to a tap on the manifold so that a small amount of the exhaust gases is bypassed to the cleaner. As soon as the engine is started, the heated gases emitted through the slot cause turbulence in the oil, with the result that the washing chamber immediately above the reservoir is completely filled with an oil spray. Outside air admitted to this chamber must pass through the spray and be deflected by a series of specially shaped baffles, the combined action of the oil spray and the baffles resulting in thoroughly washing the air and removing the dust particles. The oil-laden air then passes through a filter compartment packed with fine crimped wire, which removes the oil and completes the cleaning process. Between the washing chamber and the outer shell of the cleaner are passages which are out of the path of the air passing through the cleaner and which permit a continuous circulation of oil. Operation is entirely automatic.

Numerous operating advantages are claimed for the new cleaner. The fact that the exhaust gases are utilized for creating the oil spray contributes to the efficiency and dependability. Regardless of outside temperatures and engine operating speeds, the heated exhaust gases quickly reduce the viscosity of the oil and bring it to the necessary temperature for cleansing purposes. Proper operation of the carburetor is not subjected to interference, it is said, and the efficiency of the engine is not appreciably impaired at any operating speed.

(Continued on page 672)

Current Construction Unit Prices

Lock and Dam Near Joliet, Ill.

BRANDON Road lock and dam, being built under supervision of the U. S. Engineer Office at Chicago, is located in the Des Plaines River 2½ miles downstream from Joliet, Ill. Parts of the work have already been constructed, and a contract for $415,360 was let early in January, 1931, for completion of the project. There are two principal elements of this contract: 300,000 cu.yd. excavation and embankment work amounting to 34 per cent of the total cost, and 32,000 cu.yd. concrete amounting to 54 per cent. The contractor found earth cofferdams inclosing most of the work except the dam itself, and the working area equipped with heat, light and water. There is a spur from the Chicago & Illinois Valley Ry. to the gravel storage trestle.

The first items cover 1,462 lin.ft. of cofferdam for the dam and the lower approach. Cofferdams placed prior to this contract were of earth and rock spoil. This type was permitted, though not guaranteed as suitable for river closure, as was also the box type banked to insure stability and tightness.

Concrete is proportioned as follows for a cubic yard: (*a*) 6 bags cement; (*b*) 23 cu.ft. coarse aggregate; (*c*) enough sand to furnish 15 per cent more mortar than needed to fill voids.

Eight bids were received Jan. 2, 1931, and unit prices are given of the lowest three: A, Connolly Contracting Co., 2234 University Ave., St. Paul (contract); B, Powers-Thompson Construction Co., Joliet; C, S. J. Groves & Sons Co., Minneapolis. The average price was $532,846, or 28 per cent above low and 13 per cent below the government estimate of $609,945. Lieut. Col. W. C. Weeks is district engineer.

	A	B	C
789 lin.ft. cofferdam for dam	$30.00	$25.00	$30.00
673 lin.ft. cofferdam for lower approach	6.00	5.00	2.00
92,000 cu.yd. common excav.	.58	.40	.45
39,000 cu.yd. rock excav.	1.37	1.75	1.70
500 cu.yd. keyway excav.	9.00	8.00	4.00
14,000 sq.ft. channeling or broaching	.49	.50	.75
33,000 cu.yd. forming embankment	.30	.50	.60
122,000 cu.yd. placing backfill	.16	.25	.15
32,000 cu.yd. concrete	7.00	6.71	6.50
Total	$415,350	$425,816	$427,546

84-In. Concrete Water Conduit in Baltimore

AN 84-in. reinforced-concrete pressure pipe conduit is being installed in Baltimore from the new filtered water reservoir at the Montebello filtration plant to the end of an existing 60-in. cast-iron main from Druid Lake. Contract was let in February, 1931, to the Whiting-Turner Construction Co., Stewart Bldg., Baltimore, for $1,145,878. All work is in tunnel, 14,000 lin.ft. with six shafts.

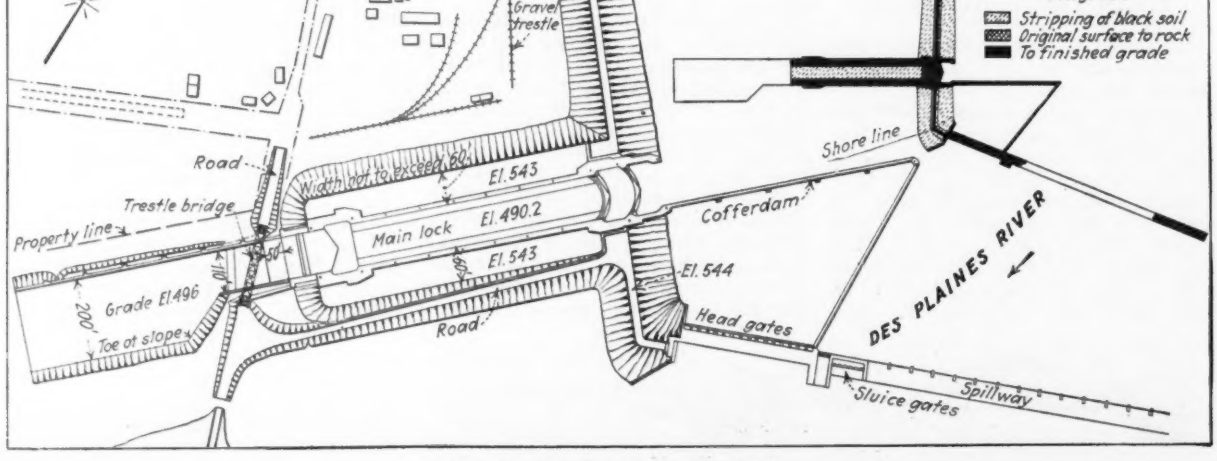
The accompanying drawing gives a typical section of the pipe at three of the shafts having depths of 67, 95 and 95 ft. The principal items of cost are excavation for the pipe and the installation, including concrete backing. The low bidder estimates these items to amount respectively to 39 and 43 per cent of the total cost. Taking the two items as 100 per cent, he estimates that 52 per cent is for furnishing and installing the pipe and 48 per cent for the excavation. The average for all the twelve bidders is exactly the same as this. The contract prices and the averages for these two items are given below:

	Contract	Average Twelve Bids
Excavation	$32.00	$38.50
Furnish and install	35.10	41.75

Excavation includes whatever kind encountered, placing timbering, disposing of spoil, and backfilling with concrete. All concrete except for the pipe is 1:2:4 for reinforced and 1:3:6 for plain. The first mix has a 28-day compressive strength of 2,500 lb., the second 1,700 lb.

The 84-in. pipe is made in 12-ft. lengths and has a wall thickness of 8 in. It is cast vertically in metal molds. Concrete for the pipe is 1:1½:2½, with compressive strength of 3,000 lb. per sq.in. Crusher dust may replace part of the sand, but the cement content must be at least one-fourth of the total volume of sand and coarse aggregate. Joints are bell and spigot, made watertight by a fiber-filled lead gasket sweated into a continuous ring which is calked from inside the pipe.

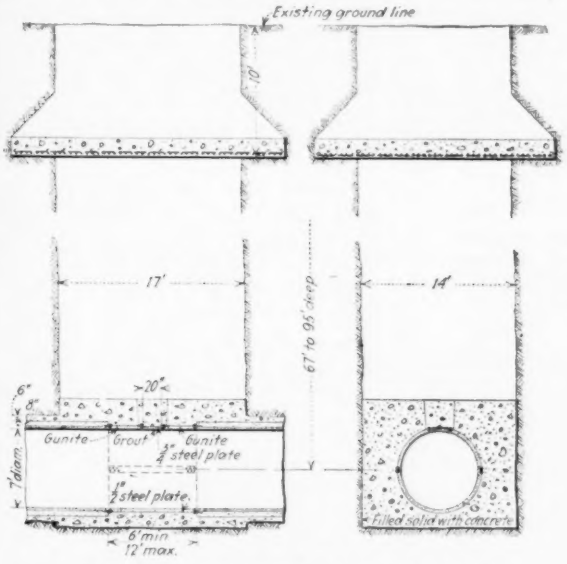
The six shafts were bid lump sum and each includes the opening operation, maintenance, and closing the shaft but does not include the filler space, which is regarded as pipe and paid for as such under the second item. The remaining items are comparatively unimportant. One is for 125 cu.yd



Plan of lock and dam near Joliet, Ill.

Current Construction Unit Prices

of excavation for surveying operations, estimated at $12 per cubic yard by the lowest bidder, $15 by the second lowest, and $5 by the third. Another item is 950 lin.ft. of 48-in. reinforced-concrete surge line. The low bidder estimates $3 per cubic yard for excavation of 1,325 cu.yd. and $19.50 per linear foot for the pipe. These prices compare



84-in. Baltimore water conduit at typical shaft

closely with the averages of the twelve bids. Payment is allowed for a trench 6½ ft. wide extending from ground surface to a point 6 in. below the bottom of the pipe. The pipe is made in 12-ft. lengths with wall thickness of 5 in. Another small item of work is guniting 5,200 sq.ft. of an existing 96-in. conduit. The application is about 2 in. thick, so that the finished surface will be on a cylinder 92 in. in diameter. The contractor's estimate of 55c. per square foot compares with the average of the other bids.

Steel Bridge Over Yellowstone River

YELLOWSTONE River bridge near Sidney, Mont., will consist of four 275-ft. steel trusses on concrete piers and abutments, with an 80-ft. steel-girder span at the north end and a 40-ft. concrete T-beam span at the south. Total length is to be 1,231 ft. 3⅜ in.; roadway width 20 ft. Clearance from navigable high-water maximum runoff elevation to bottom of steel will be 20 ft. The bridge is on the North Dakota Line highway.

Borings have been made 69 ft. deep; typical material is silt, gravel, quicksand and clay. Piers extend down 30 to 50 ft. Items 9 and 10 are for structure excavation: 730 cu.yd. for bents 1 and 2 and pier 5; 6,120 cu.yd. for piers 1, 2, 3 and 4. The contract price and the average of the lowest three bidders are $2 and $3 for item 9 and $4.50 and $5.37 for item 10.

Yellowstone River is navigable, and falsework must not obstruct river traffic more than 48 hours at a time. Pier 5 will be carried on 1,680 lin.ft. untreated piling; bent 2 on 420 lin.ft. treated piling. For the former, a minimum penetration of 15 ft. is required; and 18 ft. for the latter.

Concrete is to be three classes: A, 1:2:4 for reinforced concrete and for concrete deposited in water; B, 1:2½:5 for plain footings except in water; D, 1:2:3 for railings, pipe, slabs, beams and girders. Strengths at 28 days for the three classes are 2,000, 1,600 and 2,200 lb. All concrete of the superstructure, including slab, curbs, T-beams and handrail posts, is class D. Substructure is class A, except the bases of piers 1 to 4, which are class B. All exposed edges of concrete are chamfered 1½ in., as are fillet entrant angles.

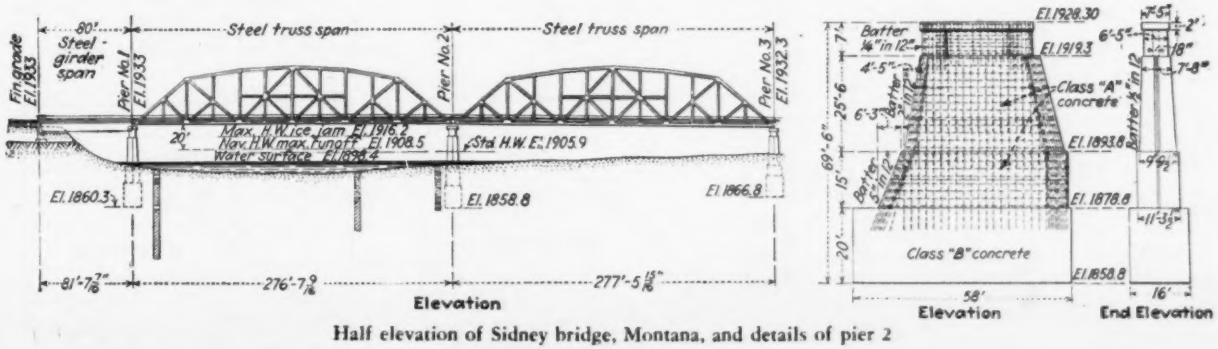
Construction details of a typical pier are shown at the right in the drawing. Heights of piers 2 to 4 are 69½ ft., 60 ft. 1⅛ in. and 62½ ft., respectively. They are 16 ft. thick by 58, 56 and 58 ft. wide. Each block of shaft above the base is to be poured continuously, with construction joints as shown. Quantities in the five piers are given below:

	1	2	3	4	5
Carbon steel, lb	1,640	1,170	1,170	1,170	580
A concrete, cu.yd	470	600	480	570	220
B concrete, cu.yd	630	690	600	620	
Reinforcing steel, lb	12,460	14,550	12,690	13,670	5,020
Excavation, cu.yd	1,320	1,480	1,440	1,880	410

Both silicon and carbon steel will be used in the bridge: silicon for certain members, plates and part of the floor system; carbon for the girder span, rivets, handrail, guard angles and nose angles.

Eight bids averaging $327,610 were received Jan. 24, 1931, by the state highway committee of Montana. Contract was awarded to the Portland Bridge Co., Portland, Ore., for $288,985. Unit prices are given of the lowest three bidders, the two others being: B, Minneapolis Bridge Co., $297,705; C, Missouri Valley Bridge & Iron Co., Leavenworth, Kan., $297,877. M. S. Hopkins is bridge engineer for the commission.

		A	B	C
Silicon steel	864,000 lb.	$0.09	$0.088	$0.75
Carbon steel	792,500 lb.	0.08	0.074	0.065
Cast steel	31,200 lb.	0.15	0.15	0.015
Class D conc	641.4 cu.yd.	18.00	24.00	23.00
Class A conc	2,390 cu.yd.	18.00	17.50	25.00
Class B conc	2,540 cu.yd.	18.00	15.50	24.00
Reinforcing steel	204,600 lb.	0.06	0.0576	0.045
Floor drains	108	3.00	4.70	5.00
Str. exc. bents 1, 2 and Pier 5	730 cu.yd.	2.00	4.50	2.50
Str. exc. piers 1, 2, 3 and 4	6,120 cu.yd.	4.50	7.10	4.50
Untreated timber piling	1,680 lin.ft.	0.50	1.00	1.00
Treated timber piling	420 lin.ft.	1.00	2.50	1.50



Half elevation of Sidney bridge, Montana, and details of pier 2

Oil-Type Air Cleaner

(Continued from page 669)

Use of the exhaust gases also insures a positive circulation of oil in the cleaner, which washes the various parts and causes the dust particles to collect at the bottom of the oil reservoir, thus making the device self-cleaning. Ordinary crankcase oil can be used and changed as often as required.

Tractor Hoist Attachment

A new side hoist for attachment to the McCormick-Deering 20 tractor has recently been announced by the Joshua Hendy Iron Works, San Francisco, Calif. This single drum unit, known as the Lawler hoist, mounts in place of the standard tractor belt pulley. The bare

Hoist mounted on tractor

drum, 10¼ in. in diameter and 7 in. between flanges, will spool 425 ft. of ⅜-in. cable. Maximum direct line pull on the bare drum is 2,000 lb. All gears have machine-cut teeth, are completely inclosed and run in oil. Drum and gears are fitted on Hyatt roller bearings. The drum is controlled by the tractor power take-off and an internal expanding brake. The hoist can be attached by any tractor mechanic in less than an hour, using tractor tools only. Because of the small space required by the hoist and its out-of-the-way location, it does not interfere with any other normal use to which the tractor may be put.

Electrode Welds Stainless Steel

A new, improved electrode for the arc welding of stainless steel has been recently developed by the Lincoln research laboratories and is now in manufacture by the Lincoln Electric Co., Cleveland, Ohio. The electrode, known as Stainweld A, is an extruded product used with the usual polarity of welding current reversed. The coating contains no carbon, eliminating all possibility of the molten weld metal absorbing carbon from the electrode coating during the welding process. Therefore the carbon content of the weld metal deposited by the new electrode will always be equal to or less than the carbon content of the stainless steel being welded. This has an important bearing upon the resistant qualities of the weld, since a slight increase in carbon in the weld permits more rapid corrosion. Welds deposited by this improved electrode are produced in a shielded arc which prevents the combination of atmospheric oxygen and nitrogen with the molten weld metal to form oxides and nitrides.

Stainweld A electrodes are manufactured in 3/32, 1/8, 5/32, 3/16 and 1/4 in. sizes of the regular 11-in. lengths.

COSTS AND CONTRACTS

E. N.-R. Index Numbers

Cost			Volume		
Apr. 1,	1931	191.63	March,	1931	278
Mar. 1,	1931	194.51	February,	1931	198
Apr. 1,	1930	207.12	March,	1930	408
Average,	1930	202.85	Average,	1930	260
Average,	1929	207.02	Average,	1929	317
1913	.....	100.00	1913	.....	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of April 16, with some comparisons, total as follows:

(In Thousands of Dollars)

	Apr. 16 1931	Average of Last Four Weeks 1931	1930
Buildings:			
Industrial	$14,153	$6,110	$9,389
Other	20,047	21,929	43,151
Streets and roads..	9,490	14,780	11,596
Other eng. constr..	20,963	20,990	15,586
Total	$64,653	$63,809	$79,723
Total, all classes, Jan. 1 to April 16:			
1931	$872,263		
1930	1,048,814		

Week's New Capital and Contracts

New securities issued last week totaled 31 millions for private and 42 for public, a total of 73 millions, compared with a weekly average of 185 millions for April, 1930. The cumulative totals for the year are 686 for private, 673 for public, 1,359 millions for both, compared with last year's figures of 2,310 millions for both private and public issues. The largest issue of the week was $34,975,000, 3¼ and 3½ New York State building bonds.

Engineering construction contracts totaled 64 millions in the second week of April, compared with a weekly average of 79 millions for the month a year ago. The cumulative figures are given below:

	1930	1931	Per Cent Change
Buildings.....	538	305	—43
Roads.....	125	164	+31
Others.....	324	338	+4
Total.....	987	807	—18

Business Notes

UNITED ENGINEERING & FOUNDRY CO., manufacturer of rolling mill equipment, has designed and built a new continuous type of copper rod mill which has a capacity of between 50,000 and 60,000 lb. of ¼-in. round rods per hour and will also operate profitably on a small production basis. The company has also designed a low-production mill, with capacity of from 10,000 to 15,000 lb. per hour.

JONES & LAUGHLIN STEEL CORP., Pittsburgh, Pa., has purchased the New Orleans plant formerly owned by the Lukens Steel Co., which is located on the site of approximately seventeen acres on the turning basin of the Industrial Canal about a mile from the Mississippi River and 6 miles from the center of the city. The plant has complete rail and water communication facilities and will be used for warehousing the company's products for distribution locally and for rail and water transport to the south, southwest, Pacific Coast and foreign countries. Jones & Laughlin have been shipping to New Orleans and other southern points by river for about ten years.

SWEET'S STEEL CO., Williamsport, Pa., has completed the installation of new mills, motor drives and slow cooling annealing beds which will increase the company's capacity approximately 80 per cent. The equipment is designed for the slow cooling of metal in annealing beds, resulting in a higher ductility of the product.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., is now producing railroad grade-crossing protection plates for pedestrian crossings which are similar in design to the highway grade crossing described in *Engineering News-Record*, June 5, 1930, p. 951.

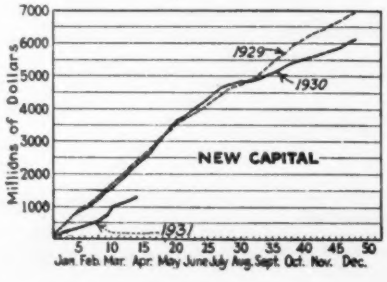
SOUTHERN PINE ASSOCIATION, at the recent annual convention held at New Orleans, La., adopted a code of ethics to govern the distribution of lumber, pledged cooperation to railroads, and voted a 5c. per 1,000 ft. tax on lumber shipped by its members to be used for advertising and sales promotion. All officers of the association were reelected.

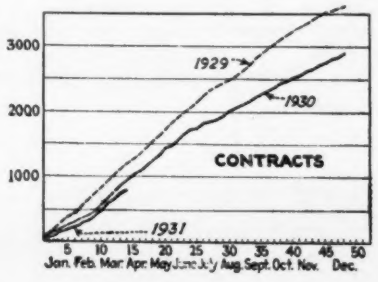
WALLACE & TIERNAN CO., INC., Newark, N. J., has acquired the assets of the Tanner Engineering Co., Long Island City, N. Y., and will, in the future, carry on the manufacture and sale of Tanner instruments for indicating and recording variations in liquid levels, vertical movements of gas-holders, positions of valves and sluice gates, or any straight line or angular motion at any distance from the point of measurement. Manufacture will be carried on at the Wallace & Tierman plant at Belleville, N. J.

AMERICAN CABLE CO., a subsidiary of the American Chain Co., Inc., has negotiated license agreements for the manufacture of preformed wire rope, by which the separate strands and wires are preformed and preshaped to the exact helical lay they assume in the finished rope, to the following companies: American Steel & Wire Co., a subsidiary of the United States Steel Corporation; General Cable Co.; five leading rope manufacturers in Canada; British Rope, Ltd., and subsidiaries, together with four other companies in Great Britain; Australian Wire Rope Works, Ltd.; Felten & Guilleaume, the largest producers of these products in Germany and continental Europe. Negotiations are pending with other manufacturers.

WILLIAM J. LINN, export manager of the Cleveland Pneumatic Tool Co. and the Cleveland Rock Drill Co., Cleveland, Ohio, has been elected vice-president of the Cleveland Export Club.

CLAUD S. GORDON CO., 708 West Madison St., Chicago, Ill., has appointed William G. Praed radiograph engineer in charge of its commercial X-ray laboratory in Chicago.





CONSTRUCTION NEWS

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Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue.

Location	*Project*	*Cost*	*Status*
Waterworks			
Boston	Water tunnel	$4,978,031	Contract
Bridges			
New Jersey	Bridge, etc.	1,716,692	Contract
Flushing (N. Y.)	Bridge	1,000,000	Proposed
New York	Bridge	1,000,000	Proposed
Excavation and Dredging			
New Westminster (B. C.)	Dredging, etc.	1,000,000	Proposed
Grade Crossing			
Elmira (N. Y.)	Grade elimination	3,000,000	Proposed
Unclassified			
Texas	Oil pipe line	1,000,000	Proposed
Federal Government			
Atlanta	Post office	2,975,000	Proposed
Kansas City (Mo.)	Post office	4,500,000	Bids asked
Springfield (Mo.)	Hospital	2,500,000	Proposed
New York	Federal court	8,250,000	Proposed
Pittsburgh	Dredging	2,540,000	Proposed
Seattle	Hospital	1,275,000	Bids asked
Factories and Mills			
St. Louis	Newspaper plant	1,500,000	Contract
Windsor (Ont.)	Canning plant	1,000,000	Proposed
Garages			
Los Angeles	Garage	1,000,000	Proposed
Power Plants			
Burlington (N. J.)	Power plant ext.	9,500,000	Contract
Kearny, (N. J.)	Power plant	1,000,000	Proposed
Buildings			
New York	Apartment	1,200,000	Separate Contracts
Pittsburgh	Hotel	4,000,000	Bids asked
New York	Y.M.C.A.	1,000,000	Contract
Boylston (Mass.)	Hospital	1,000,000	Proposed
Pine Aire Station (N.Y.)	Hospital	2,742,625	Contract
East Cleveland (O.)	Hospital	1,000,000	Contract
New York	Office	1,500,000	Proposed
New York	Court House	7,000,000	Proposed
Evanston (Ill.)	Library	1,000,000	Bids asked
Newark (N. J.)	High school	1,000,000	Proposed
Cleveland (O.)	University	2,500,000	Contract
Chicago	Theatre	1,500,000	Contract
New York	Restaurant	1,000,000	Proposed

WATERWORKS

PROPOSED WORK

Calif., Santa Barbara—City Council surveys rock fill dam below Gibralter Reservoir, 55 ft. above level of present spillway. V. E. Trace, City water supt. Noted Oct. 1.

Conn., East Berlin — Fire Dist. waterworks, $40,000 bonds authorized. Engineer not selected.

Conn., Hartford—Metropolitan Water Dist., extending mains. $200,000 bonds authorized. C. M. Saville, 1026 Main St., engr.

Ia., Keokuk—Preliminary plans waterworks. To exceed $15,000. Burns & McDonnell Eng. Co., 406 Interstate Bldg., Kansas City, Mo., engrs.

Kan., Shawnee—Waterworks. To exceed $15,000. E. T. Archer & Co., 619 New England Bldg., Kansas City, Mo., engrs.

Mich., Jackson—Waterworks extensions, improvements, incl. laying large mains to east side city, $66,500; drilling, equipping two 18 in. wells at Water St., $28,000; deep well pumps for 6 wells at Belden Rd. Station, $28,400; equipment for new 16 in. well at Belden Rd. Station and connecting into general system, $8,500. W. B. Hodges, city mgr.

Mo., Memphis—Water purification plant, $15,000. W. B. Rollins & Co., 339 Railway Exch. Bldg., Kansas City, engrs.

N. Y., New York—Committee of the whole, Bd. Estimate, City Hall, approved $50,000,000 bond issue for aqueduct to connect Kensico and Hillview reservoirs. Bd. Water Supply, J. J. Gillespie, pres.

BIDS ASKED

Ind., Bloomington—May 12, by Bloomington Water Co., at office City Clerk reservoir pipe line improvement, Pearce, Greeley & Hansen, 6 North Michigan Ave., Chicago, Ill., engrs.; adv. E. N.-R. Apr. 16.

Me., Portland—Apr. 21, by Portland Water Dist., 16 Casco St., furnishing, laying 36 and 48 in. steel and concrete pipe lines, furnishing c.i. pipe, specials. Hazen & Everett, 25 West 43rd St., New York, consult. engrs.

Ia., Des Moines—See "Contracts Awarded."

N. J., Mantoloking—See "Contracts Awarded."

N. Y., Long Island City—Apr. 21, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in 220th Pl., Utopia Parkway, Kent and Radnor Rds., Northern and Willets Point Blvd., 35th, 9th, 21st, 45th Aves., Alderton, 146th, 170th, 194th, 220th Sts.

N. Y., New York—Apr. 21, by Dpt. Water Supply, Gas & Electricity, Municipal Bldg., complete electric driven pumping plant, ventilating, heating system, and 72 in. steel discharge main at gate house, Croton Lake; 6 in. valves, appurtenances on hydrant branches in various streets, Manhattan Boro. Noted Mar. 5.

N. Y., New York—Apr. 28, by Bd. Water Supply, G. J. Gillespie, pres., 346 Bway., two 66 in. bronze suction valves, 2 lines 6 6 in. bronze waterway castings, 2 bronze doors, two 16 in. bronze gate valves, two 16 in. bronze needle valves, 18 in. and 16 in. bronze check valves, bronze piping, miscellaneous bronze; steel castings, appurtenances Drainage Shaft 9-A, City Tunnel 2. Contr. 232; est. borings in Gardiner and Plattskill, Ulster Co. and Newburg Orange Co., Contr. 310; in Wappinger and Fishkill, Dutchess Co., and Putnam Valley and Kent, Putnam Co., Contr. 311; adv. E. N.-R. Apr. 17.

Okla., Okarche—Bids about May 1, waterworks, distribution system. $50,000. Benham Eng. Co., 1106 Perrine Bldg., Oklahoma City, engrs.

Ont., Oshawa—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., San Bernardino—City Council, 4,500 ft. 16 in. sheet steel water pipe f.o.b. trench, to Los Angeles Mfg. Co., 2500 East 23rd St., Los Angeles, at $0.945 per ft. 3,750 ft. 12 in. Class 250 bell and spigot c.i. pipe f.o.b. trench, to United States Pipe & Fdry. Co., 2326 East 8th St., Los Angeles, $1.75.

Ia., Des Moines—Des Moines Water Works, C. S. Denman, genl. mgr., main extensions, own forces. $250,000. J. M. Tippee, City Hall, engr. Noted Feb. 26.

Kan., Lawrence—City Council, 1 m.g. steel reservoir, to Pittsburgh-Des Moines Steel Co., 10th and Tuttle Sts., Des Moines, Ia. $9,145.

Ky., Louisville—Louisville Water Co., 435 South 3rd St., 8 mi. 8 in. main from here to Glenview, $150,000. Owner builds. J. Chambers, 435 South 3rd St., engr.

Mass., Boston — Metropolitan Dist. Water Supply Comn., 20 Somerset St., 10 mi. 11 x 12½ ft. concrete horseshoe type tunnel, appurtenances, Coldbrook-Swift Tunnel, Wachusetts-Coldbrook Tunnel extension in Towns of Barre, Hardwick and Greenwich, to Wenzel & Henoch Constr. Co., 5025 State St., Milwaukee, Wis., $4,978,031. Noted Mar. 5.

Mich., Detroit—Dpt. Water Supply, power plant incl. part of boiler plant, machine shop, store house, garage, coal storage pit, 72 in. pipe line connection, reservoir tunnels, switch house and tubine house, for Springwells Water System, West Warren Ave. to W. E. Wood Co., Union Guaranty Bldg., $983,320. Noted Feb. 26.

Minn., Cloquet—City, 2 reservoirs, to C. A. Carlson, Cloquet $6,145. Noted Mar. 26.

Neb., Lincoln—City, steel water storage tank at 45th and Bancroft Sts., to Omaha Steel Wks., 609 South 48th St., Omaha, $15,685; laying water mains in Dist. 142, Orchard St., 51st to 52nd Sts., to Newberg & Bookstrom Plumbing & Heating Co., 1338 M St., $950; concrete paving in Dist. 821, H St. and in Dist. 815, 17th St. from Calvert to Stockwell Sts., to Cochrane Constr. Co., 822 1st Natl. Bank Bldg., $3,143 and $5,056 respectively. Grand total $24,834.

N. J., Mantoloking — Ocean Co. Water Co., Bay Head, additional wells, near present pumping station to divert maximum 575,000 gal. water daily to Boros Bay Head, Mantoloking and Breck Twp., day labor. $15,000 or more. Private plans. Noted Mar. 12.

N. Y., Brooklyn—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in 10th Ave., to Empire Contg. Co., 6 Church St., New York, $5,986; in Sea View and 20th Ave., to G. V. Cornell Constr. Co., 30 Egbert Pl., St. George, $6,399. Noted Mar. 19.

Okla., Oklahoma City—City Council, extending 16,000 ft. 6 in. c.i. mains, to Sherman Iron Wks., 18 East Main St., $23,342. Est. $25,000.

Ont., Hamilton—City Clerk, 4 low lift pumps in connection with filtration plant, to Babcock-Wilcox Goldie McCullough Ltd., Grand St. S., Galt, $14,396; wash water pumps, to Smart-Turner Co. Ltd., Barton St. E., $1,120; penstocks, to W. J. Westaway Co. Ltd., Westaway Bldg., Contr. A, $10,510, Contr. B $7,892. Grand total $33,918. Noted Jan. 29.

Ont., Oshawa—City, 1¼ mi. 6 in. c.i. mains from Simcoe St. to Harbor, day labor. $15,000. W. C. Smith, Municipal Office, engr.

Ont., Port Colborne—Town, 6 in. mains, hydrants on 9 streets, to Ryan Constr. Co. Ltd., 30 Sandwich St. East Windsor, 6 in. pipe in place at $1.65 per ft.; 6 in. valve in place $35 casting $0.06 per lb.; hydrants installed $80.56 each; corporation cocks installed $3.45; rock excav. $5.50 per yd. Est. $20,000.

Ont., Port Erie—Town, 350,000 imperial gal. steel waterworks tanks, to Horton Steel Co., Ltd., Bridgeburg, $32,500. Noted Feb. 19.

Ont., Weston—Town, drilling two 400 imperial gal. wells, supplying, installing pumps, deep wells, electric pumps, to Jordan-Roberts Sales Ltd., Morell St., Brantford. Est. $50,000.

See proposal advertising on page 98

LEADITE

Trade Mark Registered U.S. Pat. Office

Buried — to be forgotten

25,000 ft. of c.i. Bell and Spigot Pipe Line—Gregory to Ingleside, Texas.
Contractors—Wilson and Seward.

Buried beneath the Earth's surface,—unseen, and not thought of by countless peoples, lie thousands upon thousands of miles of cast iron water mains (the supply and distribution system probably being the largest part of the investment of a Water Works plant)—daily supplying to humanity one of life's greatest needs—WATER.

Water mains are usually "built for permanence,"—they must be "dependable," and their joints must also be dependable and as tight as possible,—else paved streets, beautiful estates, parks, etc., will have to be dug-up, at tremendous cost and inconvenience to water users,—IT IS THEREFORE LOGICAL THAT "GOOD PIPE" SHOULD BE LAID FOR PERMANENCE WITH "GOOD JOINTS"—That is why so many Engineers, Water Works Men and Contractors have specified and used LEADITE for over a quarter century.

The Pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%.

THE LEADITE COMPANY
Land Title Building Philadelphia, Pa.

No Caulking

SEWERS

PROPOSED WORK

Calif., Los Angeles—Bd. P. Wks., City Hall, revising specifications San Pedro Intercepting Sewer 2. Former contracts rescinded. Noted Apr. 9.

Ia., Manning — Preliminary plans complete sewage disposal plant, auxiliary piping. Nixon-Reynolds Co., 309 Grain Exch. Bldg., Omaha, Neb., engrs.

Mass., Plymouth — Town, sewerage system, $500,000. Metcalf & Eddy, Statler Bldg., Boston, engrs.

Mass., Webster—Town, sewage disposal system for Webster Lake Sect. $25,000 or more. Engineer not selected.

Mass., Whitinsville — Town, Bd. Selectmen, sewerage works, bridge, hy. improvements. $35,-800 appropriated.

Mass., Winthrop—Town, Bd. Selectmen, drainage, edgestones, resurfacing Lewis Ave., Upland Rd. and Walden St. $35,980 appropriated.

N. J., Bernardsville—New preliminary studies sewage disposal system. Clyde Potts, 30 Church St., New York, engr. Noted May 22.

N. J., Clifton—Bd. City Council, City Hall, preliminary plans sanitary sewer in Ackerman Ave. to relieve sewage overflow in Passaic River. $25,000. J. L. Fitzgerald, city engr.

O., Berea—Preliminary plans sewage disposal plant. $150,000. C. W. Root, Society for Saving Bldg., Cleveland, engr.

Okla., Oklahoma City—City Council preliminary plans Crown Heights Storm Sewer. $65,-000. G. F. Brown, City Hall, engr.

Pa., Grove City—Boro plans sedimentation type sewage disposal plant. F. P. Graham, Grove City, engr. Noted Nov. 13.

Pa., State College—See "Schools."

R. I., Providence—City, Bd. Contr. & Supply, sewerage works in Abbotsford Court, Freeman Parkway, Edgemere Ave., Richland and Simmons Sts. $25,000.

N. Y., New York—Sanitary Comn., W. Schroeder, Jr., Municipal Bldg., bids late in December, housing for fuel oil pumps, piping, tanks, Wards Island, east of Hell Gate Bridge. To exceed $25,000. Sloan & Robertson, 420 Lexington Ave., engrs. Noted Apr. 2.

BIDS ASKED

La., New Orleans—Apr. 25, by Bd. Sewerage & Water Bd., 526 Carondolet St., furnishing 4 control panels with instruments, accessories, 4 removable truck type switchboards, for motors driving vertical trash pumps at Drainage Pumping Stations 6 and 7.

Mass., Boston—Apr. 23, by Dpt. P. Wks., sewerage works in Roxbury and Brighton. $25,-000. J. A. Rourke, Dpt. P. Wks., comr.

Mass., Stoughton—See "Contracts Awarded."

Mich., Lansing — Apr. 27, by B. Ray, city clk., constructing North East Intercepting Sewer, incl. 3,400 lin.ft. 5 ft. x 5 ft.-6 in., and 1,600 lin.ft. 4 ft.-6 in. x 5 ft.-6 in. sections, together with manholes, appurtenances, special structures. S. C. Jacka, City Hall, sanitary engr.; adv. E. N.-R. Apr. 16.

N. Y., Brooklyn—Apr. 22, by H. Hesterberg, pres. Brooklyn Boro, Boro Hall, storm and sanitary sewers in Kenmore Pl. and East 27th St.; sewers in Farragut Rd. and East 88th St.

Okla., Tulsa—Apr. 21, by City Comrs., City Hall, Storm Sewer Project 5-A-3-0, Hartford Ave., et al., $26,660. H. A. Parker, Municipal Bldg., engr.

Pa., Phila.—Apr. 22, by Dpt. P. Wks., Bureau of Eng. & Surveys, A. Murdock, dir. P. Wks., Schedule A, main sewer, Lardner St. from Delaware River to point northwest of Tacony St., $190,000; Schedule B, grading, etc. Welsh Rd. Bridge over Pennypack Creek.

CONTRACTS AWARDED

Calif., San Francisco—City Council, rein.-con. sewers crossing Sunset Blvd. and Lincoln Way, to C. B. Eaton, 715 Ocean Ave., $40,050.

Ill., Chicago—City, at office Bd. Local Impvts, City Forest Preserve Sewerage System, 5.5 mi. long, 9 ft. diam. brick to 1½ ft. vitr. tile pipe in Forest Preserve Ave., Panama, Cornelia, Plainfield, Pacific, Orange, Ottawa, Waveland, Olcott and Belmont Aves., Grace and Addison Sts., to C. Roberts, 6921 Laflin St., $945,970. Est. $1,032,000.

Ill., Dupo—City Council, 30,380 ft. 8, 10 and 12 in. vitr. clay sewers, 928 wyes, 96 brick manholes, 4 brick drop manholes, 13,680 ft. 14 in. c.i. pipe for sewage force main, 10,140 lb. special castings, brick pumping station building, two 100 g.p.m. centrifugal pumps, motors, to Swords, McDougal & Lancaster, 114 Fayette St., Peoria, $75,949. Est. $90,376.

Kan., Topeka—F. W. Knapp, city clk., sewers in Oakland Park Dist. Sewer Dist. 93, incl. 49,-368 ft. 8- to 18-in. vitr. clay pipe, 323 ft. 10 in. butt wood piling, 14 ft. long, 90,000 f.b.m. new sheeting left in trenches, 6,430 ft. 2 in. c.i. water pipe, trenching, back filling, manholes, also motor driven centrifugal pump, piping, in Sewer Lifting Station in Gage Park, to T. P. Thomson 390 Forest Ave., Kansas City, Mo., $74,451. Est. $90,000. Noted Mar. 5.

Mass., Stoughton—Town, sewerage system, day labor. $25,000. B. L. Winslow, town mgr. Noted Jan. 8.

N. J., Burlington—Mayor and City Council, sewage disposal plant, to C. R. Camp, 10 South 18th St., Phila., Pa., $108,500. Noted Mar. 19.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewer in 146th Ave., to Piazza & Saladino, $6,385. Noted Feb. 5.

N. Y., St. George—J. A. Lynch, pres. Richmond Boro, Boro Hall, sewers in Liberty Ave., to Trifoglio Constr. Co., 349 Carey Ave., West New Brighton, $7,029; resurfacing Clawson St., to Vanbro Constr. Co., 24 Elizabeth St., West New Brighton, $8,245. Noted Apr. 2.

Ont., Ottawa—Nepean Twp., 3-4 mi. 8 in. and up vitr. tile sewer in Area A. $50,000. Owner builds. James, Proctor & Redfern, 36 Toronto St., Toronto, engrs.

Ont., Sandwich—Town, 3 mi. 8 in. and up, vitr. clay storm and sanitary sewers in Huron Line, Partington Ave., King and Queen Sts. $60,000. C. R. McCall, 56 Pitt St., Windsor, engr.

Ont., Toronto—City, 8 in. and up, vitr. tile, concrete sewers, brick, concrete trunk sewers, manholes, catchbasins, etc., during this year. $581,350. R. C. Harris, City Hall, engr.

Ont., Toronto—East York Twp., 4 mi. 8 in. and up, vitr. clay sewers in Todmorden Dist. and Greenwood, Danforth Park Area. $63,131. G. R. Jack, 443 Sammon Ave., engr.

Ont., Welland—Crowland Twp., 8 in. and up vitr. tile sewers, to Damore Bros., Niagara Falls; pumping station, to S. Tufts, Welland. Est. $25,000.

WASTE DISPOSAL

PROPOSED WORK

Mass., Oak Bluffs—Town, J. B. Billings, Bd. Health, incinerator in Lagoon Sect.

N. J., Irvington (br. Newark)—Town Council, Town Hall, municipal incinerator, Colt St. $160,000. Project in abeyance. Noted Mar. 5.

BIDS ASKED

Pa., Altoona—Apr. 20, by City, W. J. Hamor, city clk., refuse incinerator with preheater, chimney, building, rated capacity 3.6 tons wrapped garbage per hr. $50,000. H. J. Baum, city engr. Noted Apr. 13.

BRIDGES

PROPOSED WORK

Calif., Los Angeles—Bd. Supervs, Los Angeles Co., r.w. timber, bridge to have eight 25 ft. spans 60 ft. above canyon floor at highest point, 22 ft. roadway, 5 ft. sidewalks, frame bent on concrete piers in central portion with r.w. piling toward ends over Shoemaker Canyon in Big Pine County Park—widening six 30 ft. rein.-con. bridge from 26 to 70 ft., 5 ft. sidewalks over Santa Anita Wash at Hunting Dr.—widening 50 ft. concrete arch bridge from 31 to 50 ft. over Nigger Slough at Alameda St. W. D. Armstrong, Hall of Records Bldg., bridge engr.

Mass., Dedham—Town, Bd. Selectmen, bridges, hy. improvements, $127,000 appropriated.

Mich., Ecorse—Wayne Co. Road Comn., Barlum Bldg., Detroit, 34 ft. span beam and girder type bridge, approaches, 8 ft. clearance above water, pile founds. over Ecorse Creek. $25,000.

N. Y., Brooklyn—Dpt. Plant & Structures, Municipal Bldg., New York, bridge at Hamilton Ave. and Gowanus Canal. To exceed $600,000. **Maturity about July 1.**

N. Y., Flushing—Dpt. Plant & Structures, Municipal Bldg., New York, bridge over Flushing Creek, at Jackson Ave. $1,000,000. **Maturity late 1931.** Bids for test borings due April 9.

N. Y., New York—Dpt. Plant & Structures, Municipal Bldg., preliminary plans bridge over Harlem River at 178th St. To exceed $1,000,-000. **Maturity latter part year.**

O., Columbus—For seven 100 ft. spans concrete arch bridge, 40 ft. roadway, two 5 ft. sidewalks over Scioto River, Spring St. $250,000.

Oklahoma—State Hy. Dpt., Oklahoma City, preliminary plans 9 span 144 ft. rein.-con. trestle at Hitchcock, Blaine Co. $30,000; 1 span 140 ft. steel truss bridge on concrete piers, near Kingfisher, Kingfisher Co. $27,000. A. R. Losh, hy. engr.

Pa., Grove City—Bd. Comrs, Mercer Co., Court House, E. J. Jones, clk., 18 ft. concrete, steel span bridge over Neshanock Creek, on Mercer Rd. $25,000. **Maturity in summer.** F. P. Graham, Blair and Mill Sts., engr.

Pa., Pittsburgh—Bd. Comrs. Allegheny Co., preliminary plans bridge at Elwyn Station, near here. $60,000. V. R. Covell, 519 Smithfield St., engr.

Ont., Toronto—City, East York Twp. and York Co., concrete, brick, steel bridge on concrete abutments, piers, over old belt line railway ravine in Moore Park. $250,000. R. C. Harris, City Hall, engr.

BIDS ASKED

California—Apr. 22, by State Hy. Comn., Sacramento, six 34½ ft. span rein.-con. girder bridge on rein.-con. pile bents over Coon Creek, near Lincoln, Placer Co.—eleven 54 ft. span rein.-con. girder bridge on concrete piers, abutments, wing walls, pile founds. over San Dieguito River, San Diego Co. C. H. Purcell, hy. engr.

California—Apr. 29, by State Hy. Comn., Sacramento, bridge to have 290 ft. through steel truss, two 60 ft., four 45 ft. 6 in., one 32 ft. rein.-con. girder span on concrete piers, concrete bents and abutments over south fork Eel River at Dyerville, Humboldt Co.—bridge to have two 50 ft. steel stringer spans on concrete piers, with pile found. and eleven 42 ft. steel stringer spans on concrete pile bents, over Clear Creek 5 mi. south of Redding, Shasta Co.—bridge to have 32 ft. 6 in. rein.-con. girder span on concrete abutments with wing walls over Browns Creek, Trinity Co. C. H. Purcell, hy. engr.

Calif., Los Angeles—Apr. 27 by Bd. Comrs, Los Angeles Co., widening from 31 to 50 ft. Nigger Slough Bridge, rein.-con.

Ia., Harlan—Apr. 20, at office Auditor Shelby Co., four V-4-B I-beam spans.

Ia., Indianola — Apr. 22, at office Auditor Warren Co., 140 x 16 ft. Z-series truss bridge on standard steel pile piers with 32 ft. I-beam approaches on concrete bents.

Ia., Sac City—Apr. 20, at office Auditor Sac Co., 80 x 20 ft. pony truss bridge with two 32 x 20 ft. I-beam approach spans, 60 x 20 ft. pony truss bridge, also grading 10,000 cu.yd. road. B. D. Jones, Sac City, co. engr.

Mississippi—See "Streets and Roads."

New Jersey—Apr. 27, by State Hy. Comn., Trenton, bridge over Deal Lake, on Route 4, Ocean and Neptune Twps., Monmouth Co. A. L. Grover, ch. clk.; adv. E. N.-R. Apr. 16.

Ohio—Apr. 28, by O. W. Merrell, dir. hys., Columbus, constructing bridges in Ashtabula, Carroll, Clermont, Geauga, Jefferson, Mercer, Portage, Ross, and Scioto Counties.

Pa., Pittsburgh—Apr. 21, by R. B. Woodside, controller Allegheny Co., Court House, removing existing O'Donovan Bridge, constructing approaches to McKees Rocks Bridge 2, also paving same, incl. 51,700 sq.ft. concrete and 66,700 sq.ft. rein.-con. sidewalks, 28,800 sq.yd. concrete, 8,200 sq.yd. brick and 3,250 sq.yd. Durax granite block paving, 3,640 tons asphaltic concrete binder, 264,000 lb. reinforcing steel $410,-000, also 9,200 lin.ft. safety curb guard $4,800; superstructure for bridge over Youghiogheny River at Boston, near here, incl. 4,000,000 lb. carbon steel, 60,000 lb. cast steel, 36,500 sq.yd. bridge floor grating, 18,000 sq.ft. sidewalk grading, 90 cu.yd. concrete anchor pits, $275,-000, also safety curb guard $7,000, electrical work $6,700. V. R. Covell, 519 Smithfield St., engr.

CONTRACTS AWARDED

Arkansas—State Hy. Dpt., Little Rock, one 100 ft. steel truss span and thirty-four 33 ft. rein.-con. deck girder span bridge on precast concrete piling, concrete piers over Saline River Relief Openings, Grant and Dallas Counties, to S. V. Cohen & Co., Blytheville, $70,744 est. $78,-500; twelve 35 ft. and four 30 ft. rein.-con. deck girder spans and one 900 ft. steel truss span bridge on concrete piers, abutments, on Hope-Emmet Hy., Newstead Co., to L. H. Lacy Co., Burt Bldg., Dallas, Tex., $50,275 est. $78,150.

California—State Hy. Comn., Sacramento bridge over Lytle Creek, near San Bernardino, San Bernardino Co., to Robinson-Roberts Co., Rives-Strong Bldg., Los Angeles, $33,313. Noted Mar. 5.

Calif., Monterey—State Hy. Comn., Sacramento, rein.-con. bridge to have one 150 ft. arch span and five 25 ft. girder spans on concrete abutments, bents, over Garrapata Creek, 16 mi. south of here, also grading 0.28 mi. roadway, Monterey Co., to Hanrahan Co., Standard Oil Bldg., Sacramento, $37,836. Noted Mar. 12.

D. C., Wash.—District Comrs., District Bldg., Klingle Valley Bridge, to W. P. Thurston Co., 301 South 4th St., Richmond, Va., $459,440. Noted Mar. 20.

Ia., Cherokee—Cherokee Co., 40 x 20 ft. I-beam and 90 x 18 ft. pony truss bridges, 30 culverts, to F. Humphrey, Cherokee $14,688—1,470 ft. 15- to 36-in. rein.-con. pipe, to Sibley Cement Co., Sibley, $2,151—1,236 ft. 15, 18 and 24 in. plain concrete pipe, to Lake View Concrete Tile Co., Lake View, $584—treated dimension and lumber, to E. S. Gaynor Lumber Co., Sioux City, $2,205—plain and treated fir planks, also treated piling, to Wheeler Lumber Co., Hubbell Bldg., Des Moines, $2,167 and $1,818 respectively—3,784 ft. 18- to 36-in. corrugated culvert pipe, to Klauer Mfg. Co., Dubuque, $5,-323. Grand total $28,936. Noted Mar. 19.

Kansas — State Hy. Comn., Court House, Columbus, 13 span 500 ft. bridge, incl. ten 30 ft. deck girder, two 80 ft. and one 130 ft. concrete arch spans, Federal Aid Project 43-F, U. S. Hy. 75, Fredonia Co., to Drexel Constr. Co., Kansas City, $70,840.

Maine—State Hy. Dpt., Augusta, McCurdy Pond Bridge, New Sharon and Chesterville, to Kennebunk Constr. Co., Waterville, $17,155—Montsweag Farm Bridge, Woolwich, to Tidewater Constr. Co., Yarmouth, $6,786—Androscoggin River Bridge, Mexico and Peru, incl. removal present structure, to J. H. Kerr, Rumford, $18,553—Upper Bridge, Dresden, superstructure, to Standard Eng. & Contg. Co., 2463 Bway., Toledo, O., $6,954—substructure same bridge, to Cyr Bros., Waterville, $28,211—Barter Island Bridge, Boothbay, superstructure, to Kittredge Bridge Co., Concord, N. H., $16,432—substructure same bridge, to F. W. Carlton, Woolwich, $22,891—Austin Bridge, Bingham, to Wyman & Simpson, Augusta, $15,547. Grand total $132,529. Noted Mar. 26.

Mass., Boston—City, Dpt. P. Wks., repairing Sprague St. Bridge, Hyde Park, to New England Maintenance Co., 20 Meridian St., East Boston. Est. $25,000.

Mass., Great Barrington—Town, Bd. Selectmen, concrete, steel bridge over Housatonic River. $25,000 or more. Owner builds.

Mass., Newbury—Essex Co., Court House, Salem, reconstruction portion Plum Island Bridge over Plum Island River, to E. J. Blinn, 53 Central St., Lowell, $13,980. Noted Mar. 26.

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Bridges (Continued)

Michigan—C. A. Miller, div. bridge engr., 504 Eddy Bldg. Saginaw. FBr. 1 of 9-8-11C-2, Contr. 2, to McClintic-Marshall Corp., 1242 Book Bldg., Detroit, $3,904; Contr. 3, to Frank & Stiehl, East Lansing, for State Hy. Comn., Lansing, $25,240. Noted Mar. 19.

Michigan—H. G. Rose, div. bridge engr., Grand Rapids. MBr. 1 of 80-14-2 C-3, Van Buren Co., to T. A. Smith, Paw Paw, for State Hy. Comn., Lansing. $21,342. Noted Mar. 20 Daily.

New Jersey—State Hy. Comn., Trenton, furnishing, erecting structural steel, Route 25, Connecting Link, Hudson Co., to Phoenix Bridge Co., Phoenixville, Pa., $1,672,352—roadway embankment, Route 25, Connecting Link, Essex Co., to J. McCann, 438 Chestnut St., Kearny, $20,740—embankment Route 1, Sect. 5, West Side Park, to International Eng. Co., 26 Journal Sq., Jersey City, $23,600. Grand total $1,716,092. Noted Mar. 26.

New Jersey—State Hy. Comn., Trenton, constructing bridge over Atlantic City R.R., Atlantic City, to Hill Constr. Co., Mount Holly, $43,547. Noted Mar. 19.

South Dakota — State Hy. Comn., Pierre, bridges in Brown and Lyman Counties, to Pioneer Bridge Co., Mitchell, $23,911 and $19,394 respectively—in Spink Co., to Iowa Bridge Co., Des Moines, Ia., $17,640—in Fall River and Lawrence Counties, to Western Bridge & Constr. Co., 3867 Leavenworth St., Omaha, Neb., $12,406 and $7,939 respectively — in Haakon Co., to W. H. Pringle, Pierre, $13,178—Pennington Co., to O. Williamson, Fort Pierre, $4,100—Brown Co., to H. Pickus Constr. Co., Aberdeen, $14,513. Grand total $113,081. Noted Mar. 19.

Que., Montreal—Canadian National Rys., C. S. Gzowski, ch. engr. constr., erecting and fabrication 2,500 tons steel for viaduct and bridge, Dorchester St. (part of large terminal project), to Dominion Bridge Co. Ltd., 1111 Beaver Hall; founds. (substructure), to Northern Constr. Co., Confederation Bldg. and J. W. Stewart, Montreal, excavation, to J. W. Stewart, Montreal.

STREETS AND ROADS

BIDS ASKED

California—Apr. 22, by State Hy. Comn., Sacramento, bituminous treated crushed gravel or stone surfacing 5.3 mi. and widening 4.7 mi. with bituminous treated crushed gravel or stone borders road between Loleta and point 0.5 mi. south of Eureka, Humboldt Co.—bituminous treated crushed gravel or stone surfacing 7.3 mi. Dales Ranch-Paynes Creek Rd., Tehama Co.—grading, asphaltic concrete surfacing 12.1 mi. Goshen-Kingsburg Rd., Tulare Co.—grading 1.4 mi. road between Spanish Creek and point 1 mi. south of Keddie, Plumas Co. C. H. Purcell, hy. comr.

California—Apr. 29, by State Hy. Comn., Sacramento, grading, crusher run base, untreater crushed gravel or stone surfacing 1.7 mi. road between Placerville and railroad crossing, El Dorado Co.—0.5 mi. road between Browns Creek and Trinity River Bridges, Trinity Co.—grading, concrete and asphaltic concrete surfacing 5.5 mi. road between San Mateo Creek and Serra, Orange Co.—bituminous treated crushed gravel or stone surfacing 23.8 mi. road between Rush Creek and Hot Creek, Modoc Co.—24.5 mi. road between Hillside and Rush Creek, Lassen and Modoc Counties. C. H. Purcell, hy. engr.

California—C. H. Whitmore, dist. engr., 502 State Office Bldg., Sacramento, rejected bids Mar. 9, concrete paving 0.3 mi. at Sutter Co. Hospital.

Calif., Santa Ana—Apr. 28, by Bd. Supervs. Orange Co., grading, drainage structures, crushed gravel surfacing 2.3 mi. Santiago Canyon Rd., 30 ft. N. H. Neff, Santa Ana, co. road comr.

D. C., Wash.—Apr. 28, by District Comrs., District Bldg., repairing 30,000 sq.yd. concrete roadway, and alley pavement, 50,000 sq.yd. cement concrete sidewalk, 60,000 sq.yd. asphaltic pavement, 45,000 sq.yd. concrete bases, furnishing 16,000 tons bituminous concrete mixture for cold patching; adv. E.N.-R. Apr. 16.

D. C., Wash.—Apr. 27, by District Comrs., District Bldg., concrete paving 30,000 sq.yd. and asphaltic or alternate paving 23,000 sq.yd. New York Ave. N. E.: sheet asphalt on concrete or alternate paving 67,500 sq.yd. unimproved and asphaltic streets and avenues; adv. E.N.-R. Apr. 16.

Ill., Sycamore — Apr. 22, by State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, improving 0.599 mi. Sect. 1-M.F.T., 20 ft., De Kalb Co. G. H. Baker, engr. county roads.

Ill., Waukegan — Apr. 20, by State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, improving 6.904 mi. Sect. 48-15D, 18 ft., Lake Co., W. H. Baker, engr. county roads.

Ia., Denison—Apr. 21, at office Auditor Crawford Co., grading Charter Oak-Dunlap Rd., incl. 88,513 cu.yd. excav., 3,000 cu.yd. channel change, 105,000 sta.yd. overhaul.

Ia., Emmetsburg—Apr. 20, at office Auditor Palo Alto Co., gravel surfacing 40.5 mi. secondary roads.

Ia., Mason City—Apr. 20, at office Auditor Cerro Gordo Co., gravel surfacing 14 mi. road.

Ia., Primghar — Apr. 22, at office Auditor O'Brien Co., grading, incidental work on 12 mi. local roads. W. L. Anderson, Primghar, co. engr.

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Ia., Sigourney — Apr. 23, at office Auditor Keokuk Co., improving roads, incl. 43,000 cu.yd. earth excav., 4,000 cu.yd. gravel or crushed stone surfacing.

Ia., Waterloo — Apr. 20, at office Auditor Black Hawk Co., grading 11.25 mi. local roads, 100,000 cu.yd. excav.

Maryland—Apr. 21, by State Roads Comn., G. C. Uhl, chn., Baltimore, graveling 0.94 mi. Contr. Ch-101-84, Charles Co.—macadam paving 3.91 mi. Contr. H-113-44—4.2 mi. Contr. H-110-42, both Harford Co.—2.49 mi. Contr. W-90-64 Washington Co.; adv. E.N.-R. Apr. 16.

Mass., Boston—Apr. 21, by Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt or bitulithic paving Alhambra Rd., etc., Ward 20, $25,000—Bournedale Rd., Ward 19, $25,000—Cerdan Ave., Ward 20, $30,000—bitulithic paving Castle Island Blvd., South Boston, to exceed $50,000.

Mississippi—Apr. 22, by State Hy. Comn., Jackson, improving 5.06 mi. Hattiesburg-New Orleans Rd., Federal Aid Project 116-Reopened, near Poplarville, Pearl River Co.; incl. 85,953 cu.yd. excav., 363 lin.ft. culvert pipe, 39,340 lb. reinforcing steel, 1.98 mi. Bermuda sodding, also bridges, incl. 50,167 ft. b.m. creosoted lumber, 1,490 lin.ft. creosoted piling, 458 sq.yd. 1 in. asphaltic plank flooring, Tougaloo-Canton Rd., Federal Aid Project 79-B, Madison Co., incl. 2,666 cu.yd. subgrade treatment material, 1 mi. haul, 600 units overhaul. C. M. Williamson, dir.

New Hampshire—Apr. 23, by State Hy. Dpt., Concord, grading 6 in. one course rein.-con. on 8 in. gravel surfacing 76,944 sq.yd. Rockingham Rd., in Derry, Windham and Salem, $305,000.

New Jersey—Apr. 27, by State Hy. Dpt., Trenton, grading, rein.-con. paving 0.664 mi. Routes 21-25 and 29, Sect. 11, Newark Junction Rd., Essex Co. A. L. Grover, ch. engr.; adv. E. N.-R. Apr. 16.

N. J., Jersey City—Apr. 21, by Bd. City Comrs., City Hall, grading, asphalt on 6 in. concrete paving Orchard St., Monticello and Jordon Aves. $25,000. J. Henderson, city engr.

N. J., New Brunswick—Apr. 21, by Bd. City Comrs., Co. Records Bldg., sheet asphalt repaving Easton Ave. from Wall to Somerset Sts. and Handy and Seamon Sts. $62,000. A. Atkinson, city engr.

New York—Apr. 28, at office Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, grading, concrete paving 1.7 mi. Bronx Parkway Extension from Kitchawan Rd. to Croton Lake, and unpaved portions south of Kitchawa Rd., in New Castle and Yorktown. J. Downer, ch. engr.; adv. E.N.-R. Apr. 16.

New York—May 5, by A. W. Brandt, comr. Hys., Albany, improving hys. in Essex, Onondaga and Madison and Schoharie Counties—reconstructing hys. in Chenango, Cortland, Dutchess, Rockland, Steuben, Wayne and Ontario Counties—bridges in Delaware, Essex, Clinton, Tompkins Counties; adv. E. N.-R. Apr. 16.

N. Y., Brooklyn—Apr. 22, by H. Hesterberg, pres. Brooklyn Boro, Boro Hall, grading, asphalt on concrete paving Parott Pl., Albany, Snyder and Troy Aves., Ashford, Freeman, Taylor, and Woodhull Sts.; asphalt paving by heater method Clifton Pl., Norman, Willoughby, Chauncey, Clark, Hall, Keap, Kent, Milton, Prospect, Ryerson, St. Edwards, Starr Thornton and Varet Sts.

Ohio—Apr. 28, by O. W. Merrell, dir. hys., Columbus, grading, drainage structures, paving hys. ni 24 counties.

O., Cleveland — Apr. 21, by Bd. Comrs. Cuyahoga Co., vitr. brick, sheet asphalt or concrete paving Hilliard Rd. 5 and 6, $225,000; improving Grantwood Ave., 12,950 lin.ft. 6 x 20 sandstone curbing, 12,950 lin.ft. 4 in. french drain gutter, 26,000 cu.yd. earth excav., 21,680 sq.yd. 3 in. vitr. brick, sheet asphalt or concrete paving. $148,200. F. Williams, Court House, engr.

Pennsylvania — Apr. 23, by State Hy. Dpt., Harrisburg **(P. means Project)**, bituminous surface treated macadam or bituminous surface treated macadam on broken stone surfacing 23,026 ft. R.376, Sect. 2, Jefferson and Mifflin Twps., Allegheny Co. — 26,356 ft. R.209, Sect. 1, Lafayette and Bradford Twps., incl. 44 ft. concrete rubble gutter, McKean Co.—bituminous treated macadam surfacing 20,800 ft. Routes 183 and 283, Sect. 1, Catawissa and Franklin Twps., incl. grading 160 ft. approaches, 91 ft. rein.-con. bridge, Columbia Co. — 32,484 ft. R.588, Quincy and Guilford Twps., incl. 46 ft. rein.-con. bridge, Franklin Co. — 26,453 ft. R.267, Sect. 2, Bethel Twp., incl. 48 ft. rein.-con. arch bridge, Fulton Co.—bituminous surface treated macadam or bituminous surface treated macadam on broken stone or native stone surfacing 26,642 ft. R.112, Sect. 6, Franklin, Jefferson and Cumberland Twps., rein.-con. surfacing 65 ft. same road, also 60 ft. rein.-con. bridge, grading 100 ft. approaches, Greene Co.—19,033 ft. R.547, Sect. 2, Summit and Black Twps., Garrett Boro, Somerset Co.—49,050 ft. R.209, Sect. 1, Mead and Kinzuna Twps., incl. 98 ft. rein.-con. bridge, grading 50 ft. approaches, Warren Co. — 10,941 ft. R.209, Sect. 2, Kinzuna and Corydon Twps., also grading 532 ft. same road, Warren and McKean Counties—bituminous surface treated macadam on broken stone or modified broken stone surfacing 20,158 ft. R.302, Sect. 6, Donegal and Cook Twps., Donegal Boro, incl. 25 ft rein.-con. bridge, Westmoreland Co. S. S. Lewis, secy.

Pennsylvania—Apr. 24, by State Hy. Dpt., Harrisburg **(P. means Project)**, bituminous surface treated macadam surfacing 40,988 ft. R.267, Sect. 1, East Providence and Brush Creek Twps., incl. 39 ft. rein.-con. bridge, Bedford and Fulton Counties—20,125 ft. R.150 Spur, Bensalem Twp., Bucks Co.—15,261 ft. R.270, Uwchlan and East Caln Twps., incl. 75 drainage structures, Chester Co.—29,230 ft. R.249, Sect. 1, Greenwood Twp., Millville Boro, incl. 42 ft. rein.-con. bridge, Columbia Co. — 55,692 ft. R.122, Fannett and Toboyne Twps., incl. 36 ft. rein.-con. bridge, Franklin and Perry Counties —30,885 ft. Routes 513 and 414, Derry and Madison Twps., incl. 125 ft. rein.-con. bridge, Montour and Columbia Counties — 1,891 ft. Routes 240 and 176, White Deer Twp., incl. 14 ft. rein.-con. bridge, Union Co.—rein.-con. surfacing 3,769 ft. R.358, Application 5456, Punxsutawney Boro, Jefferson Co. — 7,383 ft. R.197, Application 7068, Douglass Twp., Montgomery Co.—bituminous surface treated macadam on native stone surfacing 62,698 ft. R.220, Sect. 3, Smithfield, Middle Smithfield and Porter Twps., incl. grading 300 ft. bridge approaches, Monroe and Pike Counties. S. S. Lewis, secy.

Pennsylvania—Apr. 30 and May 1, by State Hy. Dpt., Harrisburg, bituminous surface treated macadam and rein.-con. surfacing 74 mi. roads in Beaver, Bedford, Cameron, Centre, Chester, Jefferson, Lackawanna, Northampton, Sullivan, Tioga, Venango, Wayne and York Counties. S. S. Lewis, secy.; adv. E.N.-R. Apr. 16.

Pa., Ambridge—Apr. 20, by Boro. A. W. Johns, mgr., Borough Bldg., Merchant and 10th Sts., grading curbing, guttering 1,400 lin.ft. Vine St and Central Lane—grading, curbing, guttering, sidewalks, concrete paving 5,300 sq.yd. Melrose Ave. and 7th St.—grading, concrete paving 1,800 sq.yd. 15th St.

Pa., Pittsburgh—Apr. 21, by R. G. Woodside, controller Allegheny Co., grading, Class C paving 11,750 sq.yd. Laketon Rd., incl. 22,000 lb. reinforcing steel, Wilkinsburg Boro and Pennsylvania Twp. $117,000—16,900 sq.yd. Rochester Rd., 18,000 lb. reinforcing bars, also bridge, incl. 40,000 lb. reinforcing, Ross Twp. and West View Boro $157,000—grading, curbing, Class C concrete paving 12,800 sq.yd. Washington Pike-Greentree Branch Rd. near here, incl. 20,000 lb. reinforcing steel. $94,000. A. E. Griffith, 519 Smithfield St., engr.

Pa., Pittsburgh—Apr. 21, by R. G. Woodside, controller Allegheny Co., furnishing, erecting 60,312 lin.ft. structural steel and wire rope fence and wrought iron picket fence, incl. 350 cu.yd. Class A concrete. $57,000. A. E. Griffiths, 519 Smithfield St., engr.

S. D., Sioux Falls—Apr. 20, by Bd. City Comrs., at office W. C. Leyse, aud., concrete paving 1,760 sq.yd. Dakota Ave. and 5,576 sq.yd. Main Ave.

Tex., Dallas—Apr. 30, by C. E. Gross, aud. Dallas Co., concrete paving Industrial Blvd. from Cadiz St. to Westmoreland Rd., for Dallas Co. Rd. Dist. 1. Rollins & Clinger, Records Bldg., dist. engrs.

Tex., Freeport—Apr. 20, by City, c/o R. D. Collins, mayor, 11,200 sq.yd. one course penetration on shell or gravel base paving 23,500 sq.yd., plain shell or gravel wearing surface together with curb and gutter, walks, all necessary drainage structures, other appurtenances. $200,000. F. J. Von Zuben, 802 Fair Bldg., Fort Worth, engr.

Virginia—Apr. 28, by State Hy. Comn., Richmond, clearing, grubbing grading, drainage structures, concrete surfacing 0.8 mi. Newport News-Hilton Village Rd., Route 39, Project F-668-C Warwick Co.—clearing, grubbing, grading, drainage structures, gravel surfacing 2.7 mi. Caroline Rd., Route 38, Project F-706-AC Spotsylvania Co.—grading, topsoiling 0.1 mi. Willis Wiver Bridge approaches, incl. 7,915 lb. reinforcing and 55,000 lb. structural steel, Route 32, Project F-39-AB1 Buckingham Co.—324 ft. bridge over Piscataway Creek, incl. twelve 22 ft. and one 50 ft. steel beam spans, near Tappahannock, Route 38, Project F-646-B Essex Co. S. G. Shirley, hy. engr.; adv. E. N.-R. Apr. 16.

Washington—Apr. 28, by S. J. Humes, dir. Hys., Olympia, concrete paving 1.5 mi. State Rd. 2, Peshastin Creek to Cashmere, Emergency F.A.P. 149-A, Chelan Co.—2.2 mi. State Rd. 3, Yakima to Union Gap, F.A.P. 132-J, Yakima Co.—grading, crushed stone surfacing 2.1 mi. State Rd. 3, Colfax North, Unit of Emergency F.A.P. 145-J, Whitman Co.—resurfacing, stockpiling 31,150 cu.yd. crushed stone surfacing on 27.3 mi. State Rd. 8, Dry Creek to south of Summit, Yakima and Klickitat Counties.

Wash., Tacoma—Pierce Co. Comrs., bids about Apr. 27, surfacing Lateral Hy. 5, $41,000—1st District, $36,000 — Point-Fosdick-Langbranch Hy., $27,000—paving Lateral Hy. 5, near Eatonville, $29,500. W. E. Berry, co. engr.

Wisconsin—Apr. 21, by State Hy. Comn. and Hy. Coms. Dane, Jefferson, Green, Rock and Sauk Counties, Madison, grading, bridging 6 mi. Milwaukee-Jefferson-Madison Rd., U. S. Hy. 18, F.A.P. 268-D, Dane and Jefferson Counties—grading 5.65 mi. Illinois State Line-Emerald Grove Rock Rd., S.T.H. 140, S.A.P. 1344, Rock Co.—0.65 mi. Beloit-Evansville Rd., S.T.H. 92, S.A.P. 1145, Rock Co.—0.266 mi. Loganville Bridge Relocation, S.T.H. 23, S.A.P. 1356, Sauk Co.—4.18 mi. Stoughton-Madison-Portage Rd., U. S. Hy. 51, F.A.P. 460-C, and S.A.P. 1220, Dane Co.—constructing Clarence Bridge Rd., S.T.H. 20, F.A.P. 417-C, Green Co.—hauling 30,000 cu.yd. gravel for Beloit-Evansville Rd., S.T.H. 92, S.A.P. 1145, Rock Co.

Wisconsin—Apr. 22, by State Hy. Comn., Milwaukee, concrete paving 6 mi. Newburg-Saukville Rd., Ozaukee Co.; 2.5 mi. S.T.H. from Newbury W. Washington Co. J. A. Staransky, Milwaukee, engr.

Wisconsin—Apr. 22, by State Hy. Comn. and Hy. Comrs. Lafayette, Crawford, and Grant Counties, Div. 9, Herald Bldg., Lancaster, grading 4.55 mi. Hazzards Corners-Darlington Rd., S.T.H. 14, S.A.P. 9396 —0.51 mi. Darlington-

Streets and Roads (Continued)

Lamont Rd., S.T.H. 14, S.A.P. 9398, both Lafayette Co.—8 mi. Mount Sterling-Ferryville Rd., S.T.H. 131, S.A.P. 9279-A, Crawford Co.—Bridgeport Bridge approaches, U. S. Hy. 18, Special Bridge Project 42, Crawford and Grant Counties.

Wisconsin—Apr. 23, by State Hy. Comn. and Hy. Coms. Fond du Lac, Ozaukee and Washington Counties, 513 Commerce Bldg., Milwaukee, grading, concrete paving 0.515 mi. Van Dyne Grade Separation (approaches), U. S. Hy. 41, S.A.P. 2844, Fond du Lac Co.—8.423 mi. West Bend-Newburg Rd., S.T.H. 33, F.A.P. 444-F, and Newburg-Saukville Rd.—0.875 mi. North Washington Ave. Rd., S.T.H. 143, S.A.P. 2996, both Ozaukee Co.

Wisconsin—Apr. 24, by State Hy. Comn. and Hy. Com. Polk Co., Osceola, curbing, guttering, concrete paving Osceola Village Pavement, S.T.H. 35, S.A.P. 8434, Polk Co.

CONTRACTS AWARDED

Alabama—State Hy. Dpt., Montgomery, concrete paving 10.64 mi., Baldwin Co., to Van Gordon Constr. Co., Montgomery, $138,025—grading, drainage structures 10.7 mi., Macon and Lee Counties, to A. H. Singer, Lafayette, $71,466—7.371 mi., Macon Co., to Sutton Bros., Stahlman Bldg., Nashville, Tenn., $76,620—bridges on Tuskegee-Auburn Rd., Macon and Lee Counties, to A. G. Hunt, $9,929 and $27,985. Grand total $324,025. Noted Feb. 5.

Alabama — L. G. Smith, hy. dir., grading, drainage structures 3 mi. Greenville and Evergreen Rd., Butler Co., to P. Mathis, Florala, $33,135; bridges on same road, to S. P. Cook, Fairmount, Ga., $36,561. Noted Feb. 5.

Arizona—State Hy. Comn., Phoenix, grading 5.5 mi. Holbrook-St. John Hy., and Phoenix-Tempe Hy., Navajo and Maricopa Counties, to H. L. Royden, P.O. Box 865, Phoenix, $46,087. Noted Mar. 19.

Arizona—State Hy. Comn., Phoenix, asphalt paving 1 mi. Holbrook-Winslow Hy., to McGinty Constr. Co., 604 Luhrs Bldg., Phoenix, $23,510; improving Tucson Nogales Hy., to Heitsch & Bitten, Nogales, $68,791. Noted Mar. 12.

California — State Hy. Comn., Sacramento, grading 40 ft. wide, paving 20 ft. wide 1.5 mi. at Bostonia, San Diego Co., to Matich Bros., Elsinore, $42,505; grading 3.5 mi. and bituminous macadam on crusher run base surfacing 6.5 mi. road between Waterman Switchback and Saratoga Gap, Santa Cruz Co., to Healy-Tibbitts Constr. Co., San Francisco, $207,483. Noted Mar. 19.

California — C. H. Purcell, engr. State Hy. Comn., Sacramento, concrete paving 8.8 mi. San Diego Co., 20 ft., to E. P. Ford, San Diego, $240,751 — 11.1 mi. Monterey Co., 20 ft., to Peninsula Paving Co., Standard Oil Bldg., San Francisco, $459,358—grading, oiling 7.5 mi. Los Angeles Co., 24 ft., to Gibbons & Reed Co., Burbank, $48,749. Grand total $748,858. Noted Mar. 12.

California—State Hy. Comn., Sacramento, concrete surfacing 8.8 mi. road between La Posta Creek and Campo Rd. Junction, San Diego Co., to E. P. Ford, East San Diego, $240,751; 0.9 mi. at Galivan Overhead Crossing, Orange Co., to Griffith Co., Los Angeles Railway Bldg., Los Angeles Co., $35,807.

Calif., Los Angeles—Sepulveda Lands Co., San Pedro, grading, drainage structures, 2 course oil and rock on decomposed granite block surfacing 10,886 sq.yd. private tract of land, to C. R. Butterfield, 1401 North Gaffey St., San Pedro, $55,287.

Calif., Los Angeles—Los Angeles Co., grading, curbing, guttering, 3 in. oil macadam surfacing Central Ave., Impvt. 920, to G. Morris, 724 South Gage St., $34,975.

Calif., Salina — Monterey Co., improving Nacimento Rd. in Santa Barbara National Forest, to Owl Truck Co., Compton, $18,278. Noted Mar. 19.

Calif., San Luis Obispo—C. M. John, city clk., curbing, sidewalks, 6 and 8 in. concrete paving 156,000 sq.ft. Pacific St., to Cornwall Constr. Co., Santa Barbara, $31,353.

Colorado—State Hy. Dpt., Denver, gravel surfacing 9.883 mi. roads in Mesa Co., to Hinman Bros. Constr. Co., 1239 Washington St., Denver, $124,512; 5.076 mi. Kit Carson Co., to Mountain States Constr. Co., Central Blk., Pueblo, $49,351. Noted Mar. 5.

Colo., Denver—F. J. Altvater, mgr. Parks & Impvts., widening Bway. from Speer Blvd. to Bayaud to Western Paving Constr. Co., 5230 Wash. St., Denver, $51,803.

Connecticut—J. A. Macdonald, state hy. comr., Hartford, bituminous macadam on trap rock paving 2,493 ft. hy. Groton, to F. D. Miller, Poquetanuck St., Norwich, $13,395—trap rock water bound macadam paving 6,100 ft. Haddam, to James Mario & Son, White Plains Rd., Bridgeport, $17,534—rein.-con. paving 25,814 ft. hy. Bethany and Woodbridge, to Clark Barone Co., 595 Legion Ave., New Haven, $163,799—grading, drainage structures, 10,650 ft. hy. Marlboro and East Hampton, to Edgewood Concrete Co., 1376 Whalley Ave., New Haven, $98,404—rein.-con. paving 12,235 ft. hy. New Canaan and Norwalk, to N. H. Road Constr. Co., 1817 Dixwell Ave., New Haven, $83,647—11,850 ft. hy. Chester and Haddam, to Altieri & Petruccione, 591 Congress Ave., New Haven, $96,789—concrete encased I-beam bridge and 1,385 ft. bituminous macadam approaches at Colebrook, to A. I. Savin Co., 408 Main St., Hartford, $55,123—8 x 10 ft. concrete box culvert, 1,245 ft. trap rock waterbound macadam approaches, Guilford, to Frank Arrigoni & Son, 181 Main St., Middletown, $9,514. Grand total $538,205. Noted Feb. 26.

Idaho—A. Harbour, comr. P. Wks., Boise, crushed graveling 12.877 mi. Power Co., to W. Hoops, Twin Falls, $111,362 est. $149,251; crushed rock paving 5.109 mi. North and South Hy. between Craigmont and Lawyers Canyon, to Redmon-Turner, Inc., Yakima, Wash., $65,266 est. $87,210. Noted Mar. 26.

Illinois—State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, surfacing 7.65 mi. Chicago Heights-Cook Co. Line Rd., Route 22, Cook Co., to States Impvt. Co., 160 North La Salle St., Chicago, $176,558.

Ill., Chicago—Bd. Local Impvts., City Hall, 6 ft. concrete sidewalks on one or both sides of West 63rd, 85th, 86th, 87th, South Bishop, Laflin and Justine Sts., Balmoral, Summerdale, Berwin, Farragut, Foster, Oriole, Overhill, Ozoman and North Karlov Aves., to Banner Constr. Co., 384 North Harding Ave.—South State, West 44th and 45th Sts., South Lavergne, South Lawler, South LaClaire, South Leamington, South Laramie and Wilson Aves., to Simpson Constr. Co., 120 South La Salle St.—East 99th, 101st, 102nd, 103rd and 104th Sts., Commercial, Exchange, Muskogan, Manistee, Prairie and South Michigan Aves., to Aldrich Constr. Co., 140 South Dearborn St.—Balmoral, Higgins, North Nagle, North Natzley, North Neenah, North Natoma, Higgins, Foster, Carmen, North Nagle, North Nashville Aves., to Sewert-Callsen Co., 3865 Milwaukee Ave.—West 47th, 83rd, 74th, 75th, 76th, 82nd, 93rd, 109th, 110th and 111th Sts., South Kedzie, South Sawyer, South Spaulding, Turner, South Homan, North Damen, South Irving, Calumet, Prairie, Indiana, South Michigan, South Wabash, Jeffery, Euclid, Bennett, Constance Greiger, Ridgeland, East End and Kenney Aves., to A. Graff & Co., 30 North La Salle St.—East 55th Pl., East 122nd, Paulina, West 99th, South Green and South Sangamon Sts., Lake Park and Normal Aves., to Superior Concrete Constr. Co., 133 West Washington St.—Howard St., Birchwood, Jarvis, Northwest, North Campbell and North Rockwell Aves., to P. Lutsch, Chicago—Lincoln St., to J. J. Croake & Co., Inc., 2927 Fullerton Ave.

Ind., Anderson—Madison Co., improving Johnston Rd., to E. E. Lyst, Anderson, $3,917—Stilson and Longanecker Rds., to Daniels & McVaugh, Anderson, $7,360 and $12,530 respectively—Laudeman Rd., to M. Harmon, Elwood, $4,792. Grand total $28,599.

Ind., Anderson—Madison Co., improving 14 mi. Noland Elwood Rd., 18 ft., to W. C. Halstead Co., 1041 West 25th St., Indianapolis, $109,732. Est. $176,000.

Ind., Newcastle—Henry Co., rock asphalt surfacing U. T. Moore Rd., to J. B. Putnam, Ft. Wayne, $197,000. Est. $232,000. Noted Apr. 9.

Ind., Newcastle—Henry Co. rock asphalt surfacing C. C. Wilhoit Rd., to J. B. Putnam, Ft. Wayne, $91,000. Est. $112,236. Noted Apr. 2.

Ia., Elkador—Clayton Co., grading, drainage structures 12.72 mi. road from Millville to Turkey River and North Buena Vista, also local road, Sects. 6, 7 and 18, Boardman Twp., to J. T. Ryan, Volga, $22,559; culvert work, to T. Fisko, Garber, $1,973.

Ia., Ft. Madison—Bd. Supervs. Lee Co., grading 20 mi. secondary roads, to N. M. O'Neill, Donnellson, $36,960—placing 8,000 tons gravel on Moaar-Argyle Rd., to McDougall Constr. Co., 2927 Floyd Ave., Sioux City, $14,760—various sized culvert pipe, to Iowa Culvert & Pipe Co., Des Moines, $1,286. Grand total $53,006.

Ia., Primghar—O'Brien Co., grading, incidental work 15.45 mi. trunk roads and 4 mi. local roads, to C. W. McNamara, Sioux Falls, S. D., $26,790. Noted Mar. 19.

Ia., Rock Rapids—Lyon Co., grading 16.5 mi. local roads, to C. W. McNamara, Sioux Falls, S. D., $18,276—13 items concrete culverts, extensions, to F. T. Cummins Constr. Co., Sioux Falls, S. D.; $3,440—concrete culvert pipe, to Canton Block & Tile Co., Canton, S. D., $4,340. Grand total $26,056. Noted Mar. 19.

Ia., Sibley—Osceola Co., grading 17 mi. local roads, to M. Peterson, Laurens, $17,414; 772 ft. culverts, 816 ft. rein.-con. culvert pipe, to Sibley Cement Co., Sibley, $1,850.

Ia., Spencer—Clay Co. grading 17 mi. local roads, to A. G. Anderson, Okoboji—11.5 mi., to G. Griffin, Greenville—1,800 ft. 24- to 36-in. concrete culvert pipe, to Wilson Concrete Co., Red Oak—1,500 ft. 15- to 24-in. farm entrance culvert pipe, to Spencer Block Wks., Spencer.

Kansas—State Hy. Comn., Court House, Columbus, concrete surfacing 0.712 mi. K16-F.A.P. 37a, Montgomery Co., 20 ft. to A. G. Sherwood, Independence, $35,556.

Kansas — State Hy. Comn., Court House, Abilene, grading, culverts 5.446 mi. U. S. Rd. 83, Federal Aid Project 343-B Norton Co., to Young Constr. Co., Abilene, $28,791; 4.583 mi. same road, Sect. C, to Campbell & Lachenmaier, Miltonvale $32,515.

Louisiana — State Hy. Comn., Baton Rouge, concrete surfacing 4.657 mi. road in Sabine Parish, to H. J. Reeves, Many, $142,508—9.708 mi. Calicasieu Parish, to Couch Constr. Co., Dothan, Ala., $268,662—15.53 mi. Assumption and Lafourche Parishes, to G. L. Laboiteaux, 4629 Lewis St., Toledo, O., $353,109—amiesite surfacing 18.37 mi. Tensas Parish, to Nelson Bros., Columbia Mutual Trust Bldg., Memphis, Tenn., $320,605—asphaltic surfacing 8.61 mi. Langipahoa Parish, to James Stanton Constr. Co., Alexandria, $87,766—Lake Borgne Bridge in St. Bernard Parish, to B. N. Davis, 1006 Tchoupt St., New Orleans, $11,573. Grand total $1,184,223. Rejected bids Mar. 17, amiesite surfacing 21.21 mi. Florian-Hymes Hy., Sabine Parish. Noted Feb. 26.

Md., Baltimore—Bd. Awards, concrete paving 11,575 sq.yd. alleys listed in Alley Contr. 145, to Arundel Contg. Co., 910 Trinity St., $18,788—grading 25,000 cu.yd., Contr. 584, to J. T. Byrne, Beechfield Ave., $7,010—sheet asphalt paving 6,400 sq.yd., Contr. 592, to Baltimore Asphalt Block & Tile Co., 1320 North Monroe St., $27,659—furnishing, delivering vitr. paving blocks, to Westport, Paving Brick Co., Westport, Baltimore, $10,200. Grand total $63,657. Noted Mar. 25 Daily.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., repaving approach Prison Point Bridge, Austin St., Charlestown, to Coleman Bros. Co., 245 State St., $20,575. Est. $25,000. Noted Apr. 2.

Michigan—E. R. Benkert, resident engr., Port Huron, grading, shaping, drainage structures, concrete paving 4.692 mi. FO 32-31, Contr. 4, Huron Co., 20 ft., to Meredith & McVaugh, Warren, for State Hy. Comn., Lansing, $128,901. Noted Mar. 19.

Mich., Albion—City Clerk, grading, shaping, drainage structures, concrete paving 0.72 mi. streets, to Globe Constr. Co., Kalamazoo, $25,705.

Mississippi—State Hy. Comn., Jackson, grading, culverts, sodding, markers, bridging 5.392 mi. roads in Adams Co., and clearing, grubbing, grading, culverts, sodding, bridging 5.393 mi. Lee Co., to J. A. and H. E. Pigford, Russell, $99,548 and $60,984 respectively—0.626 mi. Rankin Co., to Shruptine Constr. Co., Canton, $4,697—3.312 mi. Stone Co., to Bates & Gaddy, Wiggins, $11,362—4.116 mi. Smith Co., to Clanke & McCaa, Jackson, $24,167. Grand total $209,722. Noted Mar. 26.

Mo., St. Louis—Bd. P. Serv., City Hall, grading, concrete paving alleys in City Blocks 463E, 3034, 4040, 5549, 5904, 5929, and 5921, to A. Lewald, Inc., 5473 Delmar Blvd., $12,936—in City Blocks 1578, 5695, 5834, 5972, and 6134, to Creech Constr. Co., 4150 Binghamton Ave., $11,236—City Block 4078, to Eyerman Contg. Co., 1210 South Grand Blvd., $1,752—City Blocks 1647, 4346S, 4383SB, and 5398, to Skrainka Constr. Co., Security Bldg., $8,441—in City Blocks 4403AW, 5389, and 540E-5404W, to Chase Constr. Co., 5230 Devonshire Ave., $7,286. Grand total $41,650. Noted Mar. 19.

Nebraska—State Hy. Dpt., Lincoln, to Blue Valley Gravel & Sand Co., Fairbury, grading, bridge, Gage Co, $7,088—to Abel Constr. Co., 308 Terminal Bldg., Lincoln, graveling 9.3 mi. Butler Co. $24,055; 8 mi. Kearny and Adams Counties $7,362; 7 mi. Pawnee Co. $9,296; 6.8 mi. Pawnee Co. $8,236; 4.1 mi. Furnas Co. $5,789; 7 mi. Red Willow Co. $9,899; 13.5 mi. Furnas Co. $18,970—to L. G. Crownover, Lincoln, 10 mi. Greeley Co. $12,141; 11.8 mi. Hamilton Co. $12,830; 4 mi. Butler Co. $1,512—to A. Einung, Nebraska City, 14.4 mi. Arthur Co. $10,964; 7.2 Keith Co. $6,768; 7.4 mi. Gage and Saline Counties $6,037; 7.8 mi. Merrick Co. $3,165; 11 mi. Nehama Co. $5,488—to Western Bridge & Constr. Co., 3867 Leavenworth St., Omaha, Neb., 11.5 mi. Rock Co. $10,475; 15.9 mi. Boone Co. $16,775; 13 mi. York Co. $10,944; 3 mi. Keya Pasha Co. $3,987—to Carstensen Sand Co., Columbus, 8 mi. Wayne Co. $17,803—to Koehler Constr. Co., Sterling, 5.9 mi. Webster Co. $4,705—to Einung Bros., Wayne, 11.3 mi. Thurson and Dixon Counties, $16,614; 8.5 Holt Co. $6,563—to Murphy Gravel Co., Fremont, 6 mi. Gage Co. $4,618; 5.7 mi. Jefferson Co. $4,330; 3 mi. Washington Co. $1,815; to E. M. Nichols, Fairmont, 9 mi. Jefferson Co. $7,687; grading 11.8 mi. Hamilton Co. $14,368—to Central Bridge & Constr. Co., Wahoo, 7 mi. Dixon and Dakota Counties $7,548—to L. F. Bushe, 4118 North 30th St., Omaha, 8.2 mi. Gage Co. $3,597—to Yant Constr. Co., 1146 Omaha Natl. Bank Bldg., Omaha, shoulder drains, Hooker Co. $945—to Norfolk Bridge & Constr. Co., Norfolk, cable and guard rail, Howard and Greeley Counties $2,888—to G. Cronkhite, Perry, Ia., Dawes Co. $1,262—to A. M. Eatson Metal Products Co., 13th and Willis Sts., Omaha, corrugated driveway culverts, Phelps Co. $90—to Tri-State Cement Products Co., Lincoln, concrete culverts, Hamilton Co. $3,797; driveway culverts, same county $911—to Monarch Eng. Co., Falls City, grading 11 mi. Pawnee and Johnson Counties, $37,067; corrugated culverts same county $7,434; driveway culverts same county $1,049—to Diamond Eng. Co., Grand Island, bridges in Sherman Co. $4,818—to Grand total $366,044. Noted Mar. 11 and 12 Daily.

New York and New Jersey—General Manager Port of New York Authority, 80-90 8th Ave., New York, paving, railing, miscellaneous construction Kill van Kull Bridge between Bayonne, N. J. and Port Richmond, N. Y., to Erickson Equipment Co., Grand Central Terminal, New York, $339,398. Noted Mar. 5.

N. Y., Buffalo—G. Fisk, comr. Pub. Wks., Municipal Bldg., widening, 3½ in. sheet asphalt repaving 10,359 sq.yd. Heriel Ave., to Erie Contg. Co., Morgan Bldg., at $6.74 per sq.yd., total $69,801.

N. Y., New York—S. Vevy, pres. Manhattan Boro, Municipal Bldg., to Venetian Contg. Co., East Bay Ave. and Tiffany St., asphalt paving West 204th St., $11,539—to Triboro Asphalt Co., 368 East 148th St., East 56th St. $6,451—to E. T. Barry, 126-06 139th Ave., Laurelton, Wall St. $5,590; granite block paving East 73rd St. $21,696; Greene St. $79,042—to Meehan Paving & Constr. Co., 90 West St., East 62nd St., $20,971—to St. George Paving Co., 415 Lexington Ave., Albany St., $5,342—to Regan Towers Co., 124 West 121st St., East 13th St. $23,620. Grand total $174,251. Noted Mar. 19.

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Streets and Roads (Continued)

Ohio—O. W. Merrell, dir. hys., Columbus, concrete widening 1.851 mi. Ashland Co., to R. W. Rankin, Ashland, $52,536 — concrete paving 6.088 mi. Hancock Co., to Dunn & Roller, Carey, $93,707—1.382 mi. Monroe Co., to Stringer & Springer Constr. Co., Wheeling Bank & Trust Bldg., Wheeling, W. Va., $67,024—4.478 mi. Clinton Rd., Ottawa Co., to Peters Bros., 729 Ewing St., Toledo, $92,341—8.366 mi. Van Wert Co., to W. L. Johnson Constr. Co., Hicksville, $148,764—1.71 mi. Monroe Co., to R. Strawser, Columbus, $41,424—brick paving, incl. furnishing, delivering brick 0.397 mi. Highland Co., to W. H. Ringwald & Sons Co., Chillicothe, $22,139—waterbound macadam paving 1.374 mi. Fayette Co., to C. C. Dodd, Spencer, W. Va., $38,282—tar macadam paving 0.319 mi. Holmes Co., to Griggs-Anderson Constr. Co., Millersburg, $7,960—1.761 mi. Hocking Co., to Mohican Constr. Co., New Philadelphia, $55,231. Grand total $619,426. Noted Mar. 19.

O., East Liverpool—For 8 in. concrete repaving Walnut St. from Clair Ave. to Pennsylvania R.R. crossing, near River Rd., 40 ft., to Mathew Grein & Sons Co., Youngstown, $29,163. Est. $30,000. Noted June 26.

O., Shaker Heights—Sheet asphalt (lake) paving East and West Belvoir Oval and Fayette Rd., to F. W. Stollfus, 1926 Schaaf Rd., Cleveland, $74,441; asphaltic macadam paving South Park Blvd., to Cleveland Trinidad Paving Co., Western Reserve Bldg., Cleveland, $20,442. Noted Mar. 12.

Oklahoma—State Hy. Dpt., Oklahoma City, grading, drainage structures 6.921 mi. U. S. Hy. 70, near Lone Grove, Carter Co., to Crushed Rock Contg. Co., Durant, $53,125. Est. $60,000.

Okla., Oklahoma City—Bd. P. Wks., City Hall, grading ,paving 11 blocks 25th and 26th Sts. in Cashion Addition, 30 ft., to M. A. Swatek & Co., 510½ West Main St., $35,402 est. $37,840—8 blocks Shartel Ave., 26 ft., to Connelly Bros., El Reno, $30,470 est. $32,400—7 blocks Pennsylvania Ave., 36 ft., to E. W. Baker & Co., 247 Southwest 21st St., $36,263 est. $38,220—resurfacing 13 blocks May Ave., 26 ft., and 2 blocks Classen St., 60 ft., to Western Paving Co., Petroleum Bldg., $19,465 and $27,027 respectively est. $25,110 and $28,000 respectively. Grand total $147,627.

S. D., Centerville—Paving, to Booth & Olsen, 620 Insurance Bldg., Sioux City, Ia., $46,392.

Tex., Dallas—At office E. Goforth, city secy., 6 in. rein.-con. paving Davis St. from east line Zang's Blvd. to point 40 ft. west of west line Rosemont Ave., to W. E. Childers Co., 2906 Spurlock St., $41,066.

Tex., Liberty—Paving 3 mi. Raywood-Hull Rd., to Stanton Constr. Co., Leavenworth, Kan.

Tex., Sinton—C. Houts, judge San Patricio Co., grading, bridging, 10 in. caliche base paving 18 mi. lateral roads, to Cage Bros., Bishop, $99,611. Est. $100,000.

Utah—State Rd. Comn., Salt Lake City, grading, surfacing 7.973 mi. Hy., from Plymouth Junction to Idaho State line. Box Elder Co., to O. Nelson, Logan, $36,254. Est. $41,892.

Utah—State Rd. Comn., Salt Lake City, graveling 16.08 mi. State Hy., San Juan Co., to J. M. Sumsion, Springville, $68,821. Est. $97,274. Noted Mar. 30.

Vermont—State Hy. Dpt., Montpelier, concrete paving 17.5 mi. hy. Rutland, Pittsfield and Brandon, to Warren Bros. Road Co., 38 Charles River Rd., Cambridge, Mass., $491,703. Noted Mar. 26.

Va., Danville — City Council, improving streets, to T. C. Laramore, Danville, $67,759.

Washington—S. J. Humes, dir. Hys., Olympia, improving 13.462 mi. Ferry Co., to E. C. Peck & Co., Harper, Ore., $119,786 — 3.902 mi. Pierce Co., to J. Warter, Sr., 631 North Fife St., Tacoma, $77,034—2.166 mi. Lewis Co., to Puget Sound Bridge & Dredging Co., 2929 16th Ave. S.W., Seattle, $50,246—11.147 mi. Whitman Co., to Goetz & Brennan, 914 Seaboard Bldg., Seattle, $349,906—2.179 mi. Whatcom Co., to Dorsey & Wilder, Inc., 2006 State St., Bellingham, $52,256—0.269 mi. Clark Co., to United Contg. Co., 310 Stock Exch. Bldg., Portland, Ore., $10,855—6.233 mi. Snohomish Co., to N. Fiorito, 844 West 48th St., Seattle, $133,033—0.718 mi. Yakima Co., to Eng. Constr. Co., 505 Lyon Bldg., Seattle, $148,346. Grand total $941,472. Noted Mar. 5.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Ind., Fowler—Bd. Comrs. Benton Co. constructing Adoph-Sass Ditch. 6.000 ft. long. $25,000. D. Heaton, Fowler, engr.

Ind., Muncie—Bd. Comrs. Delaware Co. Rea Higgin Ditch, $26,410. H. L. Janney, Muncie, engr.

B. C., New Westminster—Dominion Govt., Ottawa, Ont., plans dredging Fraser River and completing jetties at its mouth. $1,000,000. C. C. Worsfold, New Westminster, engr.

Ont., Hamilton—See "Factories and Mills."

BIDS ASKED

Ind., Logansport—Apr. 18, by Bd. Comrs. Cass Co., 12 mi. W. C. Hubenthal Ditch, incl. 235,000 cu.yd. excav. $32,000. W. Y. Walker, Logansport, aud.

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Ind., Monticello—Apr. 18, by Bd. Comrs. White Co., constructing W. M. Chapman Ditch. $26,000. P. Ward, Monticello, engr.

Ind., Winchester—Apr. 25, by Bd. Comrs. Randolph Co., excavating 6 mi. George Wise Ditch, incl. 20,614 cu.yd. excav., 6 mi. west of Ridgeville; Louis Long Ditch 2,815 cu.yd. excav., 2,936 ft. 8- to 36-in. sewer pipe, at Farmland. $29,000. A. B. Purdy, Winchester, engr.

Ia., Clinton—Apr. 29, at office Auditor Clinton Co., dragline, cleanout and enlargement work, 130,000 yd. open ditch, 4.5 mi. W. D. Anderson, Clinton, drainage engr.

Mass., Marshfield—Apr. 21, by Dpt. P. Wks., Boston, placing 6,000 tons stone, rip rap and chips in reconstruction jetties entrance to Green Harbor, 450 lin.ft. timber fence and 196 lin.ft. concrete wall. A. W. Dean, Dpt. P. Wks., Boston, engr. Noted Feb. 26.

New York—Apr. 20, by Bd. Health, S. W. Wynne, pres. Dpt. Health ,505 Pearl St., New York, digging new ditches, redigging, old ditches as to drain certain areas in salt marshlands and meadows in Brooklyn, Queens, Richmond and Bronx Boros.

Tex., Brownsville—Apr. 25, by Cameron Co. Water Impvt. Dist. 13, c/o P. W. Samuel, secy., 305 5th St., canals, levees, ditches, pumps. H. B. Livingston, Battles Bldg., San Benito, engr.

Wash., Seattle—Bd. P. Wks., bids about Apr. 26, 3,080 ft. 8- and 30-in. sewers in Ballard Dist., 24th St. W. $38,406. R. H. Thomson, city engr.

CONTRACTS AWARDED

Mass., Orleans—H. Wade, concrete and rip rap sea wall, Pleasant Bay, to G. C. Thompson, Chatham Rd. Est. $25,000.

N. Y., New York—M. Cosgrove, comr., Docks Pier "A", Battery Pl., removing old structures, dredging at site proposed West 47th to West 51 st St. Impvt., Contr. 1952, to Morris & Cummings, 44 Whitehall St., $248,290. Noted Feb. 19 Daily.

Tex., Galveston—City, c/o A. D. Sudderman, comr. Streets & Pub. Property, 2,310 ft. 4 x 2½ ft., 2,955 ft. 2½ x 2 ft., 300 ft. 5 x 7 ft., 400 ft. 5 x 6 ft. concrete drains, 940 ft. pipe laterals, 15 manholes, 44 catch basins in area east of sea wall between jetty and sea wall and between 40th and 47th Sts., to J. W. Zempter Constr. Co., 65th and J Sts., $26,061; filling in East End Flats, to J. Jacobson, 2311½ C St., $64,000.

Wis., Milwaukee—To Bentley Bros., Inc., 808 South Pierce St., 2,105 ft. concrete superstructure on timber cribs, on Lake Shore Rd. 1 at $23.40 per ft.; 460 ft. concrete superstructure 10 ft. timber cribs at $16.20 per ft.; 135 ft. concrete superstructure on sheet pipe revetment at $30 per ft.; 250 lin.ft. concrete superstructure on 250 ft. new sheet pile revetment at $50 per ft.; 7,200 tons rip rap stone at $2.28 per ton.

Bond Elections

Coming Bond Elections

Waterworks—Springfield, La., Apr. 14, $40,000. E. T. Archer Co., Kansas City, Mo., Engrs.

Bonds Voted

Waterworks—East Berlin, Conn. $40,000.
Waterworks—Audubon, Ia. $40,000.
Junior High Schools — Sacramento, Calif. $1,146,000.
High School—Hamden, Conn. $50,000.
High Schools—Knox County, Tenn. $500,000.
High School—Beeville, Tex. $150,000.

Bonds Defeated

Waterworks—Aberdeen, S. D. $750,000.

FEDERAL GOVERNMENT

PROPOSED WORK

Ala., Montgomery—POST OFFICE—Treas. Dpt. at office Sup. Archt., plans by F. Lockwood, Montgomery, post office, Church St. Noted Jan. 28.

Ga., Atlanta—POST OFFICE—Treas. Dpt. at office Sup. Archt., soon takes bids U. S. Post Office, Mitchell, Spring, Hunter and South Forsyth Sts. $3,975,000. A. Ten Eyck Brown, Forsyth Bldg., archt. Noted Jan. 22.

Ia., Sioux City—POST OFFICE—Treas. Dpt. at office Sup. Archt., sketches 4 story, basement, brick, steel, rein.-con., 6th and Douglas Sts. $775,000.

Ia., Spencer—POST OFFICE—Treas. Dpt. at office Sup. Archt., sketches post office, $100,000.

La., Monroe—POST OFFICE, etc.—Treas. Dpt. at office Sup. Archt., sketches 3 story, basement, brick, steel, rein.-con. post office and court house. $390,000.

Mich., Bay City—POST OFFICE, etc.—Treas. Dpt. at office Sup. Archt., 3 story, basement, 115 x 146 ft., brick, steel, post office and federal building, Washington Ave. $475,000.

Miss., Hattiesburg—POST OFFICE—Treas. Dpt. at office Sup. Archt., sketches rein.-con., brick, stone, post office. $245,000.

Mo., Springfield — HOSPITAL — Bureau Federal Prisons, S. Bates, supt., sketches rein.-con., brick, steel hospital. $2,500,000.

N. J., Paterson—POST OFFICE—Treas. Dpt. at office Sup. Archt., sketches 5 story, basement, brick, steel, rein.-con., plain found., Ramapo Ave. from Market and Straight Sts. $800,000.

N. Y., New York—FEDERAL COURT—Treas. Dpt. at office Sup. Archt., plans by Cass Gilbert 244 Madison Ave., federal court house, Park Row, Duane, Pearl and Park Sts. $8,250,000. Noted Feb. 19.

Okla., Ada—POST OFFICE—Treas. Dpt. at office Sup. Archt., concrete, brick, stone post office. $250,000.

Okla., Duncan—POST OFFICE—Treas. Dpt. at office Sup. Archt., sketches brick, concrete, stone post office. $125,000.

Okla., Miami—POST OFFICE—Treas. Dpt. at office Sup. Archt., sketches concrete, brick, stone post office, $235,000.

Pa., Aspinwall — HOSPITAL — Vet. Bu., Arlington Bldg., 2 story, brick, tile, concrete, Freeport Rd. $580,000. Private plans.

Pa., Erie—DREDGING—U .S. Eng., Buffalo, in Erie Harbor. $42,500.

Pa., New Castle—POST OFFICE—Treas. Dpt. at office Sup. Archt., 1 story, basement, brick, stone post office. $525,000.

Pa., New Kensington—POST OFFICE—Treas. Dpt. at office Sup. Archt., 1 story, basement, brick, stone, Westmoreland Co. $285,000.

Pa., Pittsburgh—DREDGING—U. S. Eng. open channel work in Ohio River $2,098,000, additional open channel work $212,000, lock and dam construction, $230,000, all above near here, dredging Youghiogheny River $8,500, open channel work Allegheny River, $2,500, both in western Pennsylvania.

Pa., Uniontown—POST OFFICE—Treas. Dpt. at office Sup. Archt., 1 story, basement, brick, steel post office. $265,000.

Wash., Chehalis—DREDGING—U. S. Eng. Burke Bldg., Seattle, and Port of Chehalis, dredging Chehalis River Channel. $50,000.

BIDS ASKED

D. C., Wash.—CONSERVATORY—May 21, at office D. Lynn, archt. of Capitol, 1 story, 183 x 284 ft., concrete, stone, aluminum, glass, rein.-con. pile found., for U. S. Botanic Garden; adv. E.N.-R. Apr. 16.

Ill., Milan—LEVEES, etc.,—U. E. Eng., Rock Island, bids about Apr .28, levees, spillways, culverts, excavating cut-off, for diversion Mill Creek into Rock River, for flood protection.

Ind., Vincennes — MEMORIAL — May 9, at office George Rogers Clark Sesquicentennial Com., State House, Indianapolis, George Rogers Clark Memorial, near Wabash River, F. C. Hirons & F. W. Mellor, 40 East 49th St., New York, archts.; adv. E. N.-R. Apr. 16. Noted Mar. 19.

Ia., Knoxville—QUARTERS—Apr. 28, by Vet. Bu., Arlington Bldg., officers duplex quarters and additions.

Kan., Fort Leavenworth — HOSPITAL — Apr. 21, by Con. Q.M., remodeling 2 story, basement, 50 x 50 ft., rein.-con. hospital ward. $75,000. Noted Mar. 26.

La., Shreveport—SEWER, etc.—May 12, at office Con. Q.M., sanitary sewer system, c.i. force main, Barksdale Field; adv. E.N.-R. Apr. 16.

Mass., Winthrop — HOSPITAL — Con. Q. M. bids about May 1, 2 story, basement, concrete, Fort Banks. $220,000. Noted Oct. 2.

Mich., Selfridge Field—HEADQUARTERS, etc.—May 7, at office Con. Q.M., headquarters and operations building, parachute building; adv. E. N.-R. Apr. 16.

Montana — ROAD — Apr. 24, by Pub. Rds., Missoula, reconstructing, surfacing 11.5 mi. Smet Essex Sect. Columbia Falls, Glacier Park Forest Rd., Flathead Co.

Mo., Kansas City—POST OFFICE—May 15, by Treas. Dpt. at office Sup. Archt., U. S. Post Office. $4,500,000.

Neb., Norfolk—EXTENDING, etc.—May 6, by Treas. Dpt. at office Superv. Archt., extending, remodeling U. S. Post Office, Court House; adv. E.N.-R. Apr. 16.

N. J., Camden—ELEVATOR—Apr. 27, by Treas. Dpt. at office Sup. Archt., elevator in new U. S. Post Office. Noted Feb. 19.

N. Y., New York—DREDGE—May 28, by U. S. Eng., Army Bldg., 39 Whitehall St., reconstructing, delivering one 20 in. pipe line dredge in New York Harbor; adv. E. N.-R. Apr. 16.

N. D., St. Johns—INSPECTION STATION—Apr. 28, by Treas. Dpt. at office Sup. Archt., inspection station. Noted Oct. 23, 1930.

Texas—DREDGING—June 5, by U. S. Eng., Galveston, 8,497,000 cu.yd. Sabine River-Galveston Bay Sect. Louisiana and Texas Intracoastal Waterway through Jefferson Co. and part of Chambers Co., Tex. from west of Port Arthur Canal near Intracoastal Waterway; adv. E. N.-R. Apr. 16.

Tex., Randolph Field—HEATING SYSTEM—May 1, by U. S. Eng., central warm air heating system in Engineering Shops; adv. E. N.-R. Apr. 16.

Va., Fort Monroe—SEWER—May 7, at office Con. Q.M., 12 in. sewer at Fort Monroe; adv. E.N.-R. Apr. 16.

Wash., Seattle—HOSPITAL—May 18, by Treas. Dpt. at office Sup. Archt., U. S. Marine Hospital. $1,275,000. Noted Mar. 19.

Wis., Milwaukee—CABLE—Apr. 23, by Superintendent Lighthouses, 42,400 ft. submarine wire armored cable for electric power

Federal Government (Continued)

transmission and control service; adv. E.N.-R. Apr. 16.

Wyo., Sheridan—POST OFFICE—Apr. 27, by Treas. Dpt. at office Sup. Archt., U. S. Post Office addition. $150,000.

T. H., Oahu—AMMUNITION DEPOT—Spec. 6101—June 17, by Yards & Docks, Navy Dpt., 131 buildings, 11.5 mi. railroads, 14.75 mi. roads, for Naval Ammunition Depot; adv. E.N.-R. Apr. 16. Noted Apr. 9.

CONTRACTS AWARDED

Alabama—DREDGING—U. S. Eng., Montgomery, 783,000 cu.yd. channel from Pensacola Bay to Big Lagoon from Old River to mouth Portage Creek, to Atlantic, Gulf & Pacific Co., 15 Park Row, New York, at $0.0788 per cu.yd. total $61,700. Noted Mar. 19.

Calif., San Diego—BARRACKS—Spec. 6434—Yards & Docks, Navy Dpt., extending barracks, to H. H. Golden, San Diego. $93,492.

Colorado—ROAD—Pub. Rds., Custom House, Denver, grading, draining 7.871 mi. Berthoud Pass Natl. Forest Rd., Arapahoe and Pike Natl. Forests, Grand and Clear Creek Counties, to Hinman Bros., Denver, $217,782. Noted Feb. 19.

D. C., Wash.—HYDRAULIC LABORATORY—Bureau Standards, hydraulic laboratory, to Stofflet & Tillotson, 14 West Chelton Ave., Phila., Pa., $294,887. Noted Apr. 2.

Louisiana — LEVEES — U. S. Eng., New Orleans, 375,000 cu.yd. levee work in Butler Levee, on Mississippi River, to Highways Constr. Co., Godchaux Bldg., New Orleans, $52,125: 370,000 cu.yd. Fairfield Levee and 370,000 cu.yd. Davis-Louisa Levee, to Lower Coast Constr. Co., Godchaux Bldg., New Orleans, $97,680.

La., New Orleans — EARTHWORK — U. S. Eng., Prytania St. and River Front, 490,000 cu.yd. Item B27-E, and 500,000 cu.yd. Item B-27-D, Bordelonville-West Levee on Mississippi River, 2nd New Orleans Levee Dist., to McWilliams Dredging Co., Inc., Canal Bldg., $63,161 and $64,450 respectively. Noted Feb. 26.

La., New Orleans — EARTHWORK — U. S. Eng., Prytania St. and River Front, to McWilliams Dredging Co., Inc., Canal Bldg., 520,000 cu.yd. Item B 27 B, in Bordelonville-West Levee, Mississippi River, 2nd New Orleans Levee Dist., $67,028; 520,000 cu.yd. Item B 27 A, same district $67,028; 490,000 cu.yd. Item B 27 F, $63,161; 500,000 cu.yd. Item B 27 C, $64,450. Grand total $261,667. Noted Feb. 26.

La., New Orleans—EARTHWORK—U. S. Eng., Prytania St. and River front, to H. B. Blanks, Tallulah, 355,000 cu.yd. Lot 3, Bedford-Bayou Vidal New Levee Dist., 2nd New Orleans Dist. $63,900; 1,700,000 cu.yd. Lot 2, $340,000; 1,665,000 cu.yd. Lot 1, $249,750. Grand total $653,650. Noted Mar. 19.

La., Shreveport — QUARTERS — Con. Q.M., non-commissioned officers quarters at Barksdale Field, to L. C. Maples Constr. Co., Fort Worth, Tex., $383,303. Noted Mar. 12.

Minn., St. Paul—DREDGING—U. S. Eng., 615 Commerce Bldg., St. Paul, Mar. 24, widening channel in Mississippi River, for turning basin, at St. Paul River Terminal, to Twin City Barge & Gravel Co., 817 Hennepin Ave., Minneapolis, at $0.139 per cu.yd. Noted Mar. 19.

Nev., Hawthorne—DAM—Spec. 6165—Yards & Docks, Navy Dpt., Cat Creek Dam at Naval Ammunition Depot, to T. J. Rowland, 1558 Yale Ave., Salt Lake City, Utah. $100,000. Noted Mar. 12.

Nev., Las Vegas—BOOSTER PUMPS—Bureau Reclamation, Denver, Colo., 12 booster pumps for Boulder Dam Project, to Byron Jackson Co., 2150 South Slauson Ave., Los Angeles, Calif.

Neb., York—POST OFFICE—Treas. Dpt. at office Sup. Archt., remodeling, enlarging U. S. Post Office, to W. J. Assenmacher Co., 625 North 17th St., Lincoln, $11,136. Noted Feb. 19.

New York—DREDGING—U. S. Eng., Army Bldg., 39 Whitehall St., New York, 237,500 cu.yd. Newtown Creek, to Arundel Corp., foot Fulton St., Brooklyn, at $0.448 per cu.yd., total $106,400. Noted Mar. 5.

N. Y., Mineola—QUARTERS—Con Q.M., Mitchell Field, 13 single officers quarters, to Supreme Constr. Co., 122 West 42nd St., New York, $158,257. Noted Mar. 5.

O., Jackson—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to W. B. Catching & Co., London, Ky., $65,535. Noted Mar. 5.

O., Napoleon—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to Anderson & Co., 37 West Van Buren St., Chicago, Ill., $63,500. Noted Mar. 5.

Pa., Kittanning—POST OFFICE—Treas. Dpt., at office Sup. Archt., 1 story, basement, brick, steel, to A. Blair, 1209 1st Natl. Bank Bldg., Montgomery, Ala., $80,534. Noted Feb. 26.

Pa., Phila.—RUNWAY—Spec. 6435—Yards & Docks, Navy Dpt., seaplane runway, to Merritt, Chapman & Scott Corp., Fidelity Bldg., Baltimore, Md., $44,850.

R. I., West Warwick—POST OFFICE—Treas. Dpt. at office Sup. Archt., 1 story, basement, to T. Perrone, 1026 Main St., Hartford, Conn., $85,915. Noted Mar. 26.

Va., Langley Field—QUARTERS—Con. Q.M. Fort Monroe, 20 double non-commissioned officers quarters, to M. H. Sobel Co., 1st Natl. Bank Bldg., Detroit, Mich., $353,620. Noted Mar. 5.

Va., Quantico—BOILER PLANT—Spec. 6408—Yards & Docks, Navy Dpt., boiler plant, accessories, to M. H. Pagenhardt Co., 2130 Locust St., Phila., Pa., $108,540. Noted Feb. 19.

Vt., Fort Ethan Allen—QUARTERS—Con. Q.M., 1 double set non-commissioned officers quarters, to Federal Eng. Co., 43 Tremont St., Boston, Mass., $13,906. Noted Mar. 5.

Washington—ROAD—Pub. Rds., Portland, Ore., grading, surfacing 7.34 mi. West Side Hy., Rainier Natl. Park, Pierce Co., 20 ft., to Myers & Goulter, Burke Bldg., Seattle, $161,705.

W. Va., Charleston—LOCK—U. S. Eng., Huntington, London Lock, appurtenances in Great Kanawah River 24 mi. above here, to Northport Sand & Gravel Co., Northport, N. Y., $844,782. Noted Mar. 5.

RAILWAYS

PROPOSED WORK

Montanan — B. Blum, ch. engr. Northern Pacific Ry. Co., St. Paul, Minn., and General Superintendent Bastrom, Livingston, soon take bids grading right-of-way, fill, and 1 trestle 1.5 mi. spur from tracks to Hansen Packing Co. plant, in Butte. $100,000.

CONTRACTS AWARDED

Ontario—Canadian Pacific Ry., J. M. R. Fairbairn, ch. engr., Windsor St. Station, Montreal, Que., supplying 30,000 tons No. 130 rails, for railway in Saulte Ste. Marie, to Algoma Steel Corp., Saulte Ste. Marie. Est. $2,000,000.

GRADE CROSSINGS

PROPOSED WORK

Calif., Santa Ana—City Council rejected bids rein.-con. grade separation, at 4th St. Noted Jan. 29.

N. J., Ridgewood — Bd. Village Comrs., 291 Hudson St., concrete underpass under Erie R.R., from LeRoy Pl. to Pomander Walk. $25,000. **Maturity probably soon.** R. A. Harton, village engr.

N. Y., Big Flats—Dpt. P. Wks., Albany, reconstructing hy. bridges carrying Erie R.R. and Delaware, Lackawanna & Western R.R. over Horseheads-Corning County Hy., Chemung Co. $145,000. **Maturity about June.** Railroads to share cost.

N. Y., Elmira—Erie R.R. Co., G. S. Fanning, ch. engr. 50 Church St., New York, eliminating railroad crossings at Pennsylvania Ave., Henry and Hudson Sts., Chemung Pl., Water, Market, Gray, Church, 1st and 2nd Sts. $3,000,000-$4,000,000. **Maturity about June or later.**

BIDS ASKED

Ohio—Apr. 28, by O. W. Merrell, dir. hys., Columbus, 0.213 mi. underpass, known as Worthington Grade Separation, under New York Central, Pennsylvania and Clinton, Davenport & Muscatine Railroads, on Sect. "B-1," Graville-Dublin Rd., Franklin Co. $60,637.

CONTRACTS AWARDED

N. J., Ridgefield—Bergen Co., Court House, Hackensack, eliminating grade crossing at Edgewater Ave. and Erie R.R. tracks to R. J. Fox, 565 Gorge Rd., Cliffside, $105,247. Noted Mar. 19.

DAMS

PROPOSED WORK

Ark., Mammoth Springs—Arkansas-Missouri Power Co., 72 West Adams St., Chicago, Ill., C. V. Sebaugh, dist. mgr., Blytheville, preliminary plans one 650 and one 2,550 hp. power dams on Spring River, one mi. from here, others 5 mi. down stream. $320,000.

PIERS AND WHARVES

BIDS ASKED

N. Y., New York—PIER—Apr. 21, by M. Cosgrove, comr. Docks, Pier "A," Battery Pl., reconstructing pier, foot Market St. (Pier 30, E.R.). Contr. 2036. Noted Mar. 19.

CONTRACTS AWARDED

Conn., New London—PIERS—State, Hartford, 5 finger piers, to Newport Contg. & Eng. Co., Lee Hall, Va., $135,000.

Mass., Tisbury—WHARF, etc.—Texas Co., Park Sq. Bldg., Boston, wharf, bulkhead, retaining walls and office, Vineyard Haven, to H. N. Hinkley Co., Vineyard Haven. Est. $40,000. Noted Jan. 8.

AIRPORTS

PROPOSED WORK

Conn., Hartford—Chamber of Commerce, J. B. Slimmon, chn. aviation com., 100 x 120 ft. hangar, incl. workshop, equipment for same. $35,000. I. A. Allen & Son, Inc., 100 Farmington Ave., engrs. Interstate Airways, Inc., Chamber of Commerce, lessee. Noted Apr. 2.

Man., Winnipeg—Canada Airways Ltd., W. L. Brintnell, mgr., 804 Trust & Loan Bldg., hangar. $200,000.

BIDS ASKED

Pa., Pittsburgh—Apr. 21, by Bd. Comrs. Allegheny Co., R. G. Woodside, controller, general contract administration, hangar and auxiliary buildings, Mifflin Twp. near here. $175,000; also storm sewers, $4,300. S. L. Rousch, 519 Smithfield St., archt. Noted Apr. 9.

GRAIN ELEVATORS

CONTRACTS AWARDED

Kan., Topeka—GRAIN ELEVATOR—Kansas Elevator Co., c/o C. E. Robinson Milling Co., 9th and North Sts., Salina, 87 ft. grain elevator, 104 ft. high, 53 ft. 7 in. wide, twelve 27 ft. diam., rein.-con. round tanks 17 interstice bins, 600,000 bu. capacity, at Chicago, Rock Island & Topeka R.R., in North Topeka, to J. T. McDowell, 817 17th St., Denver, Colo. Est. $70,000.

POWER AND LIGHTING

PROPOSED WORK

Indiana—Ohio Fuel Gas Co., 99 North Front St., Columbus, O., gas pipe line from Indianapolis to Muncie. $2,000,000. E. E. Griffith, Columbus, O., engr.

BIDS ASKED

Ind., Gary—See "Equipment."

Neb., Alliance—See "Contracts Awarded."

New York—May 5, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, furnishing, installing block signaling and interlocking equipment for portion Independent System City-owned Rapid Transit Railroads extending from Hudson Terminal, Manhattan, to Jay St., Brooklyn, and from Concord and Jay Sts. to Avenue C and Gravesend Ave., Brooklyn.

Ore., Astoria—See "Contracts Awarded."

Pa., Pittsburgh—Apr. 21, by R. G. Woodside, controller Allegheny Co., electric conduits for Turtle Creek Bridge. $43,000. V. R. Covell, 519 Smithfield St., engr.

CONTRACTS AWARDED

Colorado—Southern Colorado Power Co., c/o W. N. Clark, mgr., Pueblo, rebuilding transmission line from Rocky Ford to Ordway, enlarging substation at Ordway. $35,000. Owner builds.

Neb., Alliance—Dpt. Municipal Utilities, C. H. Rockey, supt. 21.1 mi. rural lines with transmission equipment, own forces. Private plans.

Ore., Astoria — Pacific Power & Light Co., Public Service Bldg., Portland, reconstructing line from Astoria to Seaside, 30 mi. new line Youngsview Valley, new extensions Sunset Beach, new transformer vault, local improvements, day labor. $135,000. H. H. Scofield, engr.

PARKS AND SPORTS

PROPOSED WORK

Calif., Berkeley — University of California rein.-con. track stadium bowl, 20,000 seating capacity. $200,000. W. C. Perry, 260 California St., San Francisco, archt.

Calif., Culver City—City Council received no bids electrolier system, incl. 2,500 marbelite standards with underground system. Will readvertise later.

Ind., South Bend—See "Schools."

Me., Kents Hill—Maine Wesleyan Seminary & Women's College, T. W. Watkins, rejected bids Mar. 20, 1 story, 70 x 120 ft. and 25 x 100 ft., brick, concrete gymnasium, locker. $70,000. Bunker & Savage, 256 Water St., Augusta, archts. Noted Mar. 19.

Mass., Nantucket—Town, Bd. Selectmen, park at Lily Pond. $25,000. Engineer not selected.

Mass., Wellesley—Wellesley College, E. F. Pendleton, pres., swimming pool, College Grounds. Funds being raised. Engineer not selected.

N. J., Garfield—Bd. City Council, City Hall, will not build concrete stadium, Athletic field at Dahnerts Lake. Project abandoned. Noted Dec. 4.

Ont., Orillia—Water, Light & Power Comm., placing all wiring in business section town underground, installing modern lighting equipment. $25,000. R. H. Starr, Orillia, engr. Noted Feb. 5.

BIDS ASKED

Me., Gorham—Apr. 22, by Town, School Bd. and Bunker & Savage, archts., 256 Water St., Augusta, 1 story, brick gymnasium, rear of Senior High School. $25,000. Noted Mar. 26.

Mass., Brookline—Apr. 17, by Park Comrs., 2 story, brick, steel field house, Pudderham Playground. $72,000. Kilham, Hopkins & Greeley, 9 Park St., Boston, archts. Noted Apr. 9.

N. Y., Long Island City—Apr. 21, by Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, New York, paving walks in Highland Park; improving athletic field, Astoria Park.

N. Y., New York—Apr. 21, by Park Bd., W. R. Herrick, pres. Park Dpt.; Arsenal Bldg., Central Park, improving Devoe Park; excavating tree pits, placing top soil, in James Lyons Park, Bronx Boro.

Okla., Tulsa—Bd. Comrs. Tulsa Co., Court House, O. G. Weaver, clk., taking bids 1 story, 208 x 308 ft., concrete, steel coliseum 5,000 seating capacity, State Fair Grounds. $225,000. Shumway & Cross, Alexander Bldg., archts. C. M. Pritchard, 524 Robinson Bldg., engr.

CONTRACTS AWARDED

Calif., Bakersfield—See "Buildings-Unclassified."

Calif., Fresno—See "Buildings-Unclassified."

Calif., Los Angeles—See "Buildings—Unclassified."

Calif., Paso Robles—See "Buildings—Unclassified."

Calif., Sacramento—See "Buildings—Unclassified."

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Parks and Sports (Continued)

Calif., Santa Barbara—See "Buildings—Unclassified."

Mass., Mattapan (sta. Boston)—See "Hospitals."

Mo., Kansas City—Pla Mor Operating Co., Spring and Main Sts., remodeling swimming pool, to Fogel Constr. Co., Reliance Bldg. Est. $150,000. Noted July 10.

N. Y., Long Island City—Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, New York, curbing, paving area at service building Forest Park and improving triangular plot, Sunnyside Park, to P. K. Kelly Contg. Co., 6009 Woodside Ave., Woodside, $9,895 and $6,373 respectively; metal pipe drain in Willowbrook Park, to Vanbro Constr. Co., 24 Elizabeth St., West New Brighton, $21,811; filling in swamp in Willowbrook Park, to C. M. Bristow, Lyndhurst, N. J., $30,619. Grand total $68,698. Noted Mar. 26.

N. Y., Rockaway Beach—Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, New York, foundation work for bath pavilion Jacob Riis Park, to Wheeler Eng. Co., 369 Lexington Ave., New York, $48,600. Noted Mar. 26.

Pa., California—See "Schools."

HEATING AND VENTILATING

BIDS ASKED

Ind., Michigan City—Apr. 18, by W. H. Daly, warden Indiana State Prison, furnishing, installing new water tube boilers, mechanical stokers, steam engine or turbine with generator. Former bids rejected. O. N. Mueller, 610 Indiana Trust Bldg., Indianapolis, state consult. engr. Noted Mar. 26, under "Unclassified."

CONTRACTS AWARDED

Mass., South Hadley — Mount Holyoke College, M. E. Wolley, pres., heating and ventilating in science building, physical chemical laboratory, gymnasium and swimming pool, to Holyoke Valve & Hydrant Co., Race St., Holyoke; plumbing, to E. H. Friedrich Co., 73 Sargent St. Est. $25,000. Noted Apr. 2, under "Schools, contracts awarded."

Mass., Watertown—Town J. B. Barnet, chn. building comn., heating in administration building and police station, to V. J. Kenneally Co., 10 West 5th St., South Boston; plumbing, to D. F. Keefe, 14 Merchants Row; electrical work, to Watertown Electric Co., 26 Alfred Rd. Est. $25,000 or more. Noted Apr. 2, under "Public, Contracts Awarded."

N. J., Menlo Park—State Bd. Institutions & Agencies, State Office Bldg., Trenton heating and plumbing for New Jersey War Veterans' Home, to Elling Bros., 336 North Grove St., Somerville, $9,694 and $18,865 respectively; electrical work, to Willur Electric Co., 377 Jewett Ave., West New Brighton, N. Y., $10,197. Grand total $48,756. Noted Mar. 19, under "Public."

N. Y., Brooklyn—Arbuckle Bros., foot Jay St., heating, fuel oil equipment for 6 story food products manufacturing plant, John and Jay Sts., to Petroleum Heat & Power Co., 511 5th Ave., New York. Est. $25,000.

UNCLASSIFIED

PROPOSED WORK

N. J., East Orange—MEDICAL CENTER—Medical Building Corp., A. W. Bingham, pres., 219 Harrison St., 3 story, basement, brick, steel, 144 Harrison St. $150,000. **Maturity about June.** Noted Apr. 2.

O., Cleveland—STEEL PLATE TANK, etc.—Gulf Refining Co., c/o E. H. Gibson, asst. engr. of constr. Battery Park Bldg., New York, 23 steel plate tank, 8,154,600 gal. capacity; 100 x 166 ft. warehouse; 40 x 60 ft. office; 85 x 156 ft. garage; 12 x 18 ft. gasoline station; 40 x 60 ft. boiler house and machine shop; 40 x 60 ft., pump house, all foregoing brick and steel; 9 x 215 ft. tank car loading rack, 30 x 83 ft. truck filling building, both steel; 1 mi. rein.-con. dyke wall, 15 ft. high, 2 ft. thick, West 3rd St. and Jefferson Ave. Est. $1,000,000. Private plans.

O., Akron—STEEL TANKS—See Factories and Mills."

O., Youngstown—STEEL TANKS—See "Factories and Mills."

Pennsylvania — GAS PIPE LINE — Peoples Natural Gas Co., 545 William Penn Way, Pittsburgh, J. B. Tonkin, vice-pres., surveys 100 mi. gas pipe line from Lawrenceville, Pa., to New York state line, to convey natural gas from Tioga fields, right-of-way 18 to 20 ft. wide.

Texas—OIL PIPE LINE—Texas Co., 135 East 42nd St., New York, surveys for construction oil pipe line from Lathrop area north of Longview to Nacogdoches, connecting there with line to Port Neches and Port Arthur Refineries, also construct 75 mi. trunk lines and number gathering lines. $1,000,000. Private plans.

BIDS ASKED

Mass., Newburyport — TOWER — See "Contracts Awarded."

N. Y., Brooklyn — CONCRETE TANK ENCLOSURE—See "Contracts Awarded."

N. Y., Brooklyn—STAIRWAY—Apr. 21, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, additional stairway to Flatbush Ave. Station of part Eastern Parkway Rapid Transit R.R., Agreement "JZ."

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N. Y., New York—ELEVATORS, etc.—Corporation, c/o Mayer Rapport, 295 Madison Ave., taking bids and opened same about Apr. 11, elevators, plumbing for apartment, 338 West 56th St. $40,000. I. Kudroff, 15 West 38th St., archt.

N. Y., New York—SHED, etc.—Apr. 22, by A. Goldman, comr. Plant & Structures, Municipal Bldg., shed over Slip 3, Whitehall Ferry Terminal; and ferry racks at South St. Noted Mar. 19.

N. Y., New York—STEEL BINS, etc.—Apr. 17, by Dpt. Hospitals, J. G. W. Greeff, comr., Municipal Bldg., installing steel bins in elevator storehouse, and 1 compressed air medical lock, incl. apparatus, East Pavilion, at Metropolitan Hospital, Welfare Island; installing new steam return and hot water lines from boiler house to new male dormitory building, City Hospital; repairing, replacing refrigerating plant equipment, power house, Randalls Island.

Utah, Helper—FIRE PIPE—See "Contracts Awarded."

Utah—GAS PIPE LINE—See "Contracts Awarded."

CONTRACTS AWARDED

California—GAS PIPE LINE—Southern Fuel Co., Garland Bldg., Los Angeles, 25 mi. 26 in. natural gas pipe line between Long Beach and Glendale (unit of 210 mi. line from Kettleman Hills to Long Beach) to Lindgren & Swinerton, Inc., 225 Bush St., San Francisco; manufacturing pipe, to A. O. Smith Corp., 315 West 9th St., Los Angeles.

Me., Portland—COAL CYLINDERS—Deering Coal & Wood Co., 221 Forest Ave., erecting 5 coal cylinders, cast together vertically, 50 ft. high, to Nickelson & Co., Chrysler Bldg., New York, $300,000.

Mass., Malden (br. Boston)—COMFORT STATION—Park Comrs., 1 story, concrete, brick, Huntings Field, to W. M. Bailey Co., 88 Broad St., Boston. Est. $25,000. Noted Apr. 2.

Mass., Newburyport — TOWER — Town, c/o Atkinson Common Comn., A. Hitt, chn., 20 Oakland St., brick, steel memorial tower, 65 ft. high, concrete found., separate contracts. $25,000. Private plans. Noted Mar. 12.

Mass., Palmer—ELEVATORS— Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, elevators in female nurses home and reception hospital building at State Hospital, to Portland Elevator Co., 123 Oliver St., Boston. Est. $25,000. Noted Nov. 27, 1930, under "Hospitals."

Mass., Tisbury—FOUNDATION—Standard Oil Co. of New York, Park Sq. Bldg., Boston, concrete found. for tanks, wall, to W. Manter, Vineyard Haven. Total est. $40,000.

N. J., Point Pleasant—BOARDWALK—Bd. Boro Council, Boro Hall, timber boardwalk from Water St. to Manasquan Jetty, to O. J. Mellee, Long Branch. Est. $25,000. Noted Apr. 9.

N. Y., Brooklyn—CONCRETE TANK ENCLOSURE—D. Wortmann, archt., 116 Lexington Ave., New York, concrete tank enclosure, Normand and Kingsland Aves., day labor and separate contracts, for Standard Oil Co. of New York, 26 Bway., New York. $40,000. Architect taking bids on materials. Noted Apr. 2.

O., Grafton—GRAIN STORAGE TANKS, etc.—United Mills Corp., H. E. Irwin, pres., Grafton, 20 grain storage tanks, grinding equipment, crushers, bins, hoppers, to Jones-Hettelsater Constr. Co., 600 Mutual Bldg., Kansas City, Mo. Est. $100,000.

Texas—PIPE—Texas Corp., 135 East 42nd St., New York, 50 mi. 12 in. pipe for oil pipe line from point in East Texas to Gulf of Mexico, to A. O. Smith Corp., 27th and Keefe Sts., Milwaukee, Wis.

Texas and Arizona — GAS PIPE LINE — Western Gas Co., El Paso, Tex., ditching, laying, covering for gas pipe line from El Paso, Tex. to Bisbee, Ariz., to Bechtel-Kaiser Co., San Francisco, Calif. $500,000. Noted Mar. 5.

Utah—GAS PIPE LINE—Wasatch Gas Co., L. Fitzpatrick, pres., 45 South Main St., Salt Lake City, 22.5 mi. 6 in. welded steel pipe from Midvale to Pleasant Grove, day labor. $400,000. J. C. Roberts, Salt Lake City, engr.

Utah, Helper—FIRE PIPE—City, furnishing 6 mi. 10 in. creosoted fire pipe, to Federal Tank & Pipe Co., 5332 24th St., N. W., Seattle, Wash., $18,583; installing same, day labor. Total $30,000.

MATERIALS

BIDS ASKED

ROAD GRAVEL, etc.—**Long Island City, N. Y.**—Apr. 20, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., 10,000 cu.yd. cementatious road gravel, 35,000 cu.yd. broken stone and screenings, 400,000 gal. asphaltic macadam binder; 60,000 cu.yd. steam ashes; 400,000 gal. fuel oil; 500,000 gal. asphaltic macadam binder.

PIPE, etc.—**New York, N. Y.**—Apr. 22, by P. J. Dooling, comr. Purchase, Municipal Bldg., c.i. pipe, castings, valves, hydrant parts, wet connection sleeves to Dpt. Water Supply, Gas & Electricity.

POSTS, etc.—**New York, N. Y.**—Apr. 17, by P. J. Dooling, comr. Purchase, Municipal Bldg., spruce and cedar or locust posts to Dpt. Docks; fabricated structural steel to Dpt. Plant & Structures.

CONTRACTS AWARDED

GATE VALVES—**Los Angeles, Calif.**—Bd. P. Wks., City Hall, furnishing 20, 24 and 30 in. gate valves for City Water and Power Dpt., to Rensselaer Valve Co., Los Angeles, $20,550.

COPPER TUBING — **Oakland, Calif.** — J. H. Kimball, secy. East Bay Municipal Utility Dist., 50,000 ft. ¾ in. seamless copper tubing, to Rolph Mills & Co., 525 Market St., San Francisco, at $0.14 per ft.

CEMENT — **Illinois** — State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, 1,500,000 bbl. cement, to Marquette Cement Mfg. Co., Oglesby; 500,000 bbl., to Lehigh Portland Cement Co., Oglesby; 400,000 bbl., to Alpha Cement Co., La Salle; 500,000 bbl., to Medusa Portland Cement Co., Dixon; 900,000 bbl., to Universal Atlas Cement Co., Buffington, Ind., and Hannibal, Mo.; 275,000 bbl., to Dewey Portland Cement Co., Union Bank Bldg., Davenport, Ia.; 275,000 bbl., to Missouri Portland Cement Co., 1010 Pine St., St. Louis, Mo.; 650,000 bbl., to Lone Star Cement Co., Limedale, Ind.

WATER PIPE—**Chicago, Ill.**—Dpt. P. Wks., City Hall, 3,673 tons c.i. water pipe as follows: 6 in. pipe, to Alabama Pipe & Fdry. Co., 122 South Michigan Ave., at $39.75 per ton; 8 in., to Glamorgan Pipe Co., 122 South Michigan Ave. $39.90; 12 in. pipe, to Lynchburg Pipe Co., 122 South Michigan Ave., $40.40.

BRIDGE LUMBER, etc.—**Algona, Ia.**—Kossuth Co., to Wheeler Lumber, Bridge & Supply Co., Hubbell Bldg., Des Moines, 3 x 12 in. x 16 ft. and 3 x 12 in. x 18 ft. fir lumber at $30.50 per M ft., cedar piling $0.20 per ft., creosoted Southern pine piling $0.345; to Iowa Pipe & Tile Co., Mason City, corrugated culvert pipe at $0.515; to Wilson Concrete Co., Red Oak, 15 in. concrete culvert pipe, $0.365. Noted Mar. 12.

LUMBER, PIPE, etc.—**Cherokee, Ia.**—See "Bridges."

VITRIFIED CLAY PIPE—**Maine**—State Hy. Comn., Augusta, vitrified clay pipe, to Winslow & Co., Portland; corrugated pipe culverts, to New England Metal Culvert Co., 10 Alger St., South Boston, Mass.; c.i. pipe culverts, to Amer. Casting Co., 141 Milk St., Boston. Est. exceeds $5,000.

BATTERY MATERIAL—**Boston, Mass.**—Dpt. School Buildings, battery material, as specified, to General Electric Co., 372 Stuart St., $11,036. Noted Mar. 26.

IRON CASTINGS, etc. — **Boston, Mass.** — Supply Dpt., P. A. Chapman, supt., iron castings, to Mechanics Iron Fdry. Co., 38 Kemble St., Roxbury, $37,303. Noted Mar. 26.

MANHOLE STEPS—**Boston, Mass.**—Supply Dpt., wrought iron manhole steps, to Gibby Fdry. Co., 96 Condor St., East Boston, at $0.299 each. Noted Mar. 26.

STEEL PIPE FITTINGS, etc.—**Boston, Mass.**—Transit Dpt., 1 Beacon St., 700 tons deformed reinforcing rods, to Truscon Steel Co., 260 Tremont St., $28,700.

VITRIFIED SEWER PIPE, etc. — **Newton, Mass.** — City, Street Comrs., to C. H. Spring Co., Newton Lower Falls, 65,000 ft. vitr. pipe $13,009, 18,000 ft. concrete pipe $9,065, 400,000 brick, $6,174; to Waltham Lime & Cement Co., 216 Newton St., Waltham, 12,000 bbl. portland cement, at $2.08 per bbl.

SCREENINGS, etc. — **Newton, N. J.** — Bd. Freeholders Sussex Co., Court House, 9,000 tons dustless screenings and 1,800 tons 1½ in. stone, to Limestone Products Corp., Newton, $18,360 and $2,953 respectively; 1,000 tons 2½ in. stone, to Morris County Crushed Stone Co., Morristown, $1,850; 350 tons calcium chloride, to Hart & Iliff, Newton, $9,177. Grand total $32,340. Noted Apr. 2.

ROAD OIL—**Toms River, N. J.**—Bd. Freeholders Ocean Co., Court House, 628,017 gal. asphalt tar for roads, to Tar Asphalt Co., New Brunswick, $29,391. Noted Mar. 5.

SLAG—**Cleveland, O.**—Cuyahoga Co., 20,000 tons slag, to France Stone Co., 2nd Natl. Bank Bldg., Toledo, $27,000. Noted Mar. 19.

CREOSOTED TIES—**Phila., Pa.**—Dpt. City Transit, c/o C. E. Myers, City Hall Annex, 8,600 Type A, 100 each Types B and C, 3,800 Type AX, 525 Type BX and 5,480 Type E creosoted ties for subway, Contr. 322, to Atlantic Creosoting Co., Inc., Norfolk, Va., $18,406. Noted Mar. 12.

MANHOLES STEPS, etc.—**Milwaukee, Wis.**—Central Bd. Purchases, 10,000 malleable iron manhole steps, to South Side Malleable Casting Co., 14th and Windlake Aves., at $0.4975 each; 4 dump bodies, to Heil Co., 26th and Montana Aves., $1,470. Noted Mar. 6 Daily.

TRANSFORMER CASES, etc. — **Milwaukee, Wis.** — City, c.i. transformer cases, to Municipal Foundries, West Allis, $2,361; 20- to 54-in. c.i. pipe, to U. S. Pipe & Fdry. Co., 71 Bway., New York, at $38.40 per ton, total $220,429; 20 and 54 in. gates valves, to Kennedy Valve & Mfg. Co., 228 North Jefferson St., at $265 and $2,640 respectively; 48 and 30 in. valves, to Michigan Valve & Fdry. Co., 1 Madison Ave., New York, $1,990 and $980 respectively.

RUBBLE STONE, CRUSHED STONE, etc. — **Kingston, Ont.** — City, H. S. Dick, engr., City Hall, furnishing, delivering rubble stone, and crushed stone in quarry, to J. M. Roddy, Kingston; limestone dust f.o.b. cars, Kingston, to Kirkfield Crushed Stone Co., foot of Bathhurst St., Toronto, $3.85 per ton; sand, delivered, to L. G. Freeman, Kingston, $1 per cu.yd.; port-

Materials (Continued)

land cement, to W. B. Dalton & Sons, Kingston, $2.87½ per bbl.; paving asphalt, f.o.b. Kingston, to Imperial Oil Co., 56 Church St., Toronto, $20.50 per ton; vitr. tile sewer pipe, to National Sewer Pipe Co. Ltd., Metropolitan Bldg., Toronto; c.i. manholes, etc., to T. G. Bishop, Kingston, $4.80 per cwt. Est. $30,000.

EQUIPMENT

PROPOSED WORK

POLICE and FIRE ALARM EQUIPMENT—**Gary, Ind.**—Bd. Safety purchasing police and fire alarm equipment. $200,000. A. Johnson, mayor.

ASPHALT PLANT, etc. — **Niagara Falls, Ont.** — City, W. S. Orr, engr., City Hall, purchasing asphalt plant, incl. road repair plant, heater, portable mixer. $15,000-$25,000.

BIDS ASKED

GRADER—**Pine City, Minn.**—Apr. 20, by A. P. Edin, aud. Pine Co., elevating grader. H. Jorgenson, co. hy. engr.

PUMP—**Cleveland Heights, O.**—City, H. H. Canfield, c. mgr., taking bids furnishing, erecting 1,000 gal. pump. F. A. Pease Eng. Co., Terminal Tower, Cleveland, engr.

DUST COLLECTOR, HEAT DRYER, etc.—**Pittsburgh, Pa.**—Apr. 21, by R. G. Woodside, controller Allegheny Co., Bakerstown Asphalt Plant—dust collector $1,500; North Bessemer—asphalt bin $5,850; repairs to asphalt plant boilers $3,000; Bakerstown Asphalt Plant Internal Heat Dryer $6,000; locomotive train car body $5,000.

TRACTOR and ROAD GRADER—**Austin, Tex.**—May 4, by Travis Co., c/o R. C. Archer, judge, furnishing 1 new fully equipped tractor, weight not less than 10 tons, f.o.b. Austin; also one 12 ft. regulation model fully equipped road grader, f.o.b. Austin. J. G. Morgan, Austin, co. engr.

FOREIGN

Germany, Misburg—Preussag & Elwerath Oil Companies, c/o contractor, Dubbs process oil refinery, to Arthur McKee & Co., M. R. Walton, in charge, 2422 Euclid Ave., Cleveland, O.

New Zealand, Wellington—May 19, by Secretary Dpt. P. Wks., 2250 extra high tension suspension strings complete with fittings for Aropouno Power Plant.

New Zealand, Wellington—June 2, by Dpt. P. Wks., supply 2 outdoor type automatic inductors voltage regulators, for Lake Coleridge Power Plant.

New Zealand, Wellington—June 30, by Secretary P. Wks. & Tenders Com., sluice gates, stop logs for Waitaki Power Development.

Commercial Buildings

RESIDENTIAL

BIDS ASKED

Ill., Galesburg—T. O. Miles & J. J. Sperry taking bids 3 story, basement, 179 x 179 ft., incl. 25 car garage in basement, North and Kellogg Sts. $200,000. P. R. Payne & Co., Bondi Bldg., archts.

N. J., Asbury Park—T. Maugeri, Hamilton, taking bids on separate contracts 3 story, basement, 40 x 120 ft. brick, steel, apartment, stores, 3rd and Ridgeway Aves. $150,000. Private plans.

N. J., Elizabeth—See "Contracts Awarded."

N. J., Newark—See "Contracts Awarded."

N. Y., Brooklyn—See "Contracts Awarded."

N. Y., New York—See "Contracts Awarded."

N. Y., New Brighton (sta. Staten Island)—See "Contracts Awarded."

O., Cleveland—C. E. Roseman, pres. Standard Drug Co., 408 St. Clair Ave., taking separate bids 3 story, basement, 77 x 134 ft., brick, 14510 Milverton St. $150,000. L. R. Walker, 1900 Euclid Bldg., archtl.

Pa., Pittsburgh—Governor Investment Co., J. K. Tenor, pres., c/o Simons, Brittain & English, archts., 814 Magee Bldg., bids about June 15, Governor Tenor Hotel, 34 story, basement, 66 x 110 ft., 10th and Liberty Sts. $4,000,000. R. Hartje, Webster Hall, in charge.

Ont., Toronto—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Oakland—Owners, c/o L. Ford, archt., 1435 Harrison St., 6 story, basement, brick, steel, Lennox Ave., to F. Miller, Syndicate Bldg., $200,000.

N. J., Elizabeth — K.G.O. Constr. Co., 80 Broad St., 3 story, basement, 55 x 115 ft., brick, steel, Elm St., separate contracts. $150,000. W. L. Finne, 1201 East Grand St., archt.

N. J., Newark—M. Gray & J. Kinvant, 830 Broad St., 5 story, basement, brick, steel, 2-6 Renner Ave., separate contracts. $200,000. H. F. Clark, 39 Central Ave., archt.

N. Y., Brooklyn—Corporation, c/o A. Kaskel, 473 13th Ave., 6 story, basement, Parkside and Bedford Aves., separate contracts. $150,000.

N. Y., Brooklyn—H. B. Construction Corp., A. Borden, pres., 26 Court St., 6 story, Avenue P. and Ocean Ave., separate contracts. $250,000. M. A. Cantor, 186 Joralemon St., archt.

N. Y., Brooklyn—Francar Holding Corp., S. Carner, pres., 1231 East 27th St., 6 story, 100 x 110 ft., East 41st St. and Kings Highway, separate contracts. $175,000. Seelig & Finkelstein, 153 Pierrepont St., archts.

N. Y., Brooklyn—Rennerts Builders, Inc., 737 Avenue Z, apartment, East 34th St. and Avenue W, separate contracts. $150,000. B. Driesler, Jr., 153 Remsen St., archt.

N. Y., Brooklyn—M. Segal, 80 Linden Blvd., 6 story, 84 x 114 ft., Sterling St. and Nostrand Ave., separate contracts. $190,000. Cohn Bros., 215 Montague St., archt.

N. Y., Brooklyn—Sheco Realty Corp., A. Shevirch, secy., 302 Avenue C, 6 story, 14th Ave. and 55th St., separate contracts. $195,000 M. Hirsch, 350 Stone Ave., archt.

N. Y., Brooklyn—Time Constr. Corp., 2436 84th St., apartment, East 3rd St. and Avenue P separate contracts. $150,000. I. Kallich, 26 Court St., archt.

N. Y., Brooklyn—Three Thousand Four Hundred Five Kings Highway Corp., 2 Lafayette St., 6 story, 93 x 100 ft. apartment, Kings Highway and East 34th St., separate contracts. $160,000. M. M. Weinstein, 93 Court St., archt.

N. Y., New Brighton (sta. Staten Island)—J. Loguidice, 145 Crowell Ave., Dongan Hills, 4 story, basement, brick, steel, Silver Lake Rd. and Brighton Ave., separate contracts. $150,000. A. Giambalvo, 375 Fulton St., Brooklyn, archt.

N. Y., New York—Axelrod Walker Corp., H. Axelrod, pres., 1860 Bway., 21 story, 50 x 100 ft., 113th St. and Amsterdam Ave., separate contracts. $1,200,000. G. F. Pelham, 570 7th Ave., archt. Noted Apr. 2.

N. Y., New York—Morcol Holding Corp., 349 East 149th St., 6 story, 50 x 151 ft. apartment, Morris Ave. and 167th St., separate contracts. $175,000. B. Bleich, 565 East Tremont Ave., archt.

Ont., Toronto — N. Martin, 125 Rosemount Ave., three 4 story, basement units, brick, concrete, steel, separate contracts. $150,000. J. Hunt Stanford & Son, 57 Queen St. W., archts.

CLUBS

PROPOSED WORK

Calif., San Francisco—Y. M. C. A., Powell and Clay Sts., sketches by J. Morgan, Merchants Exch. Bldg., 6 or 7 story, steel concrete club, Powell and Clay Sts. $250,000.

N. J., Jersey City—J. F. Jackson, archt., 137 East 45th St., New York, soon lets contract 7 story, basement, brick, steel, addition, Fairview Ave., for Y.M.C.A., S. H. Lipscomb, genl. secy., 654 Bergen Ave. Est. $300,000. Noted Apr. 2.

BIDS ASKED

In., Waterloo — Waterloo Y.M.C.A., S. A. Cohagen, secy., bids about May 10, 4 story, 120 x 132 ft., concrete, marble, tile club, West 4th St. $300,000. Mortimer B. Cleveland, 424 East 4th St., archt. Noted Mar. 26.

N. Y., New York—National Bureau Y.M.C.A., 347 Madison Ave., general contract Negro branch, to E. Corning, 204 East 39th St. Est. $1,000,000. Contractor taking bids on separate contracts. Noted Mar. 12.

N. Y., New York—Railroad Y.M.C.A., Natl. Bureau Y.M.C.A., 347 Madison Ave., general contract club, to Babor Comeau, Grand Central Terminal. Est. $2,000,000. General contractor awarded structural steel, to Palmer Steel Co., 342 Madison Ave. Contract awarded in February. Excavating. Noted Jan. 8.

N. Y., New York—Y.W.C.A., 129 East 52nd St., altering offices, classrooms, increasing boiler capacity, 144 West 138th St., to Dall Hayden, Treat, Inc., Grand Central Terminal. Est. $200,000.

HOSPITALS

PROPOSED WORK

Mass., Belmont—McLean Hospital, F. H. Packard, supt., Pleasant St., plans by Wadsworth, Hubbard & Smith, 11 Beacon St., Boston, and takes bids latter part month, 3 story, basement, brick, cast stone nurses home. $150,000.

Mass., Boylston—Worcester Co., W. Goodale, chn. comrs., Court House, plans by Frost, Chamberlain & Edwards, 390 Main St., Worcester county tuberculosis hospital, on Kendall Farm. $1,000,000.

Mass., New Bedford—St. Luke's Hospital, S. Whitcher, supt., Allen St., medical ward, Page, Allen W. and Taber Sts. $150,000 or more. Architect not selected.

Mass., Westfield—Commonwealth of Massachusetts, Westfield State Sanatorium, A. Holmes, supt. constr., sketches by Stevens & Lee, 45 Newbury St., Boston, brick employees dormitory, nurses home. $150,000.

Mass., Westfield—Noble Hospital, M. Smylie, supt., sketches by M. B. Harding, 10 Main St., children's unit at hospital. $150,000. Noted Feb. 5.

N. J., Hackensack—Hackensack Hospital, G. G. Ackerson, pres., 3rd St., 4 story, basement, brick, steel addition. $450,000. **Maturity probably in June.** Noted Mar. 19.

N. J., Newark—Bd. City Comrs., City Hall, sketches by J. T. Sampson, 45 Walnut St., sketches 2 story, basement, 35 x 110 ft., brick, steel, ward and recreation wing, Ivy Hill Almhouse grounds. $200,000.

Pa., Concord — Bd. Comrs. Delaware Co., Media, plans by C. W. Brazer, Crozer Bldg., Chester, tuberculosis hospital. $600,000.

Ont., Ottawa—Sisters of Grey Nuns, King Edward Ave., new hospital for St. Vincent Hospital, Carling Ave. $300,000. Architect not selected.

BIDS ASKED

N. J., Morris Plains—Apr. 22, by Dpt. Institutions & Agencies, State Office Bldg., Trenton, general contract 2 story, basement, brick, steel attendents buildings, State Hospital Grounds. $150,000. C. N. Leathem, Jr., Div. Architecture & Constr., Trenton, archt.

R. I., Providence—City, City Hospital, altering and constructing 2 story, basement, brick, steel isolation hospital addition, to A. F. Smiley Constr. Co., 202 Oak Hall Bldg., Pawtucket; heating to Files Engrg. Co., 31 Bourn St.; plumbing to T. R. Douglas, 22 Sabin St.; electrical work to C & K Electric Co., 632 Broad St. Est. $150,000. Private plans. Noted Mar. 12.

Wis., Fond du Lac — Apr. 21, by Schmidt, Garden & Ericksen, archts., 104 South Michigan Ave., Chicago, Ill., 4 story, basement, brick, steel nurses home for St. Agnes Hospital. $200,000.

Tex., Galveston—Apr. 20, by R. L. White, archt., c/o State University, Austin and Galveston, 3 story, basement, brick, steel, rein.-con., nurses home, 30,000 sq.ft. floor space, plain found., for State. $300,000.

CONTRACTS AWARDED

N. J., Holmdel—Dpt. Institutions & Agencies, State Office Bldg., Trenton, general contract reception hospital and treatment building at New Jersey State Hospital, to E. M. Waldron, 40 Park Pl., Newark, $655,000. Noted Mar. 19.

N. Y., Pine Aire Station—Comr. Dpt. Mental Hygiene, State Office Bldg., Albany, general contract 4 continued treatment buildings; 1 kitchen and dining room, at Pilgrim State Hospital, to J. McWilliams, Inc., 11 East 44th St., New York, $2,473,000; sanitary work, to C. M. Darmstadt, Inc., 35-3 42nd St., New York, $194,875; electrical work, to Engert-Hellman Co., Grand Central Terminal, New York, $74,750. Grand total $2,742,625. Noted Feb. 26.

O., East Cleveland (br. Cleveland)—Huron Road Hospital, S. Reynolds, supt., 8811 Euclid Ave., Cleveland, 6 story, basement, brick, steel, concrete hospital, service building, to John Gill & Sons, Bulkley Bldg., Cleveland. Est. $1,000,000. Noted Dec. 11.

CHURCHES

PROPOSED WORK

Mass., Arlington (br. Boston)—Church of Our Saviour (Episcopal), W. N. Bixby, pastor, 38 Marathon St., soon takes bids 2 story, basement, irregular sized, stone, stucco parish house, church tower, plain found., Marathon St. $150,000. C. C. Coveny, 184 Boylston St., Boston, archt. Noted Dec. 4.

Mass., Fall River — Sacred Heart Roman Catholic Parish, E. Carr, pastor, 163 Winter St., plans by Maginnis & Walsh, Statler Bldg., Boston, 3 story, basement, brick, stone, Linden St. $275,000. Noted Dec. 11.

N. J., East Orange—First Congregational Church, E. R. Holden, pastor, 2 North Grove St., 2 story, basement, brick, steel church. $150,000. Project in abeyance. Noted Mar. 26.

N. J., Jersey City—Sacred Heart Roman Catholic Church, M. J. Ripple, pastor, Bayview and Jackson Aves., 4 story, basement, brick, steel convent, rectory, education and social center, Bayview and Bidwell Aves. $500,000. **Maturity probably soon.**

N. J., Newark—Franklin Memorial Church, 107 Franklin Ave., church, Maple and Keer Aves. $150,000. **Maturity about August.** F. Y. Parsons, 949 Bway., New York, archt. Noted Jan. 2.

N. J., Passaic—St. Peter's and Paul's Polish National Congregation, J. Wroblewski, pastor, 126 River Dr., rebuilding 2 story, basement, brick, steel church, rectory, Armory Park. $150,000. **Maturity soon.**

N. J., Westwood—Jewish Community House, Prospect St., plans by H. Smith, Bway., Hillsdale, 2 story, basement, brick, steel, stucco synagogue, Nicholas Ave. and Washington St. $150,000. Noted Mar. 26.

Pa., Pittsburgh—R. Marlier, archt., Empire Bldg., soon lets contract brick church, 1,000 seating capacity, Arlington Ave., for St. Henrys Roman Catholic Congregation, J. Meyer, pastor, 2420 Arlington Ave. $150,000.

Ont., Toronto—Monastery of Our Lady of Charity, 14 West Lodge Ave., plans by A. W. Holmes, 79 St. Joseph St., 3 or 4 story, basement, brick, stone, concrete, steel convent, house of refuge. $500,000.

Ont., Toronto—Deer Park United Church, St. Clair Ave. W., 2 story, basement, brick, stone, concrete Sunday school. $150,000. Architect not selected.

BIDS ASKED

Conn., Middletown—See "Contracts Awarded."

Ind., Bloomington—Luthern Church bids about June 1, University Luthern Church, incl. chapel, manse, brick, steel, East 7th and Fess Sts. $150,000. A. Grindle, West 5th St., archt. Noted Oct. 23.

N. Y., New York — Apr. 20, by Hellenic Eastern Orthodox Church, 46 East 92nd St., church, 319 East 74th St. $300,000. Thomp-

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Churches (Continued)

son, Holes & Converse, 101 Park Ave., archts. Noted Apr. 2.

CONTRACTS AWARDED

Calif., San Francisco—Shea & Shea, archts., 454 Montgomery St., general contract Class A, rein.-con. church, 2,000 seating capacity, for Roman Catholic Archbishop, 1100 Franklin St. to S. Rasori, Call Bldg., $186,000. Noted Mar. 9.

Conn., Middletown—St. Sebastian Roman Catholic Church, A. Santolini, 930 Dixwell Ave., 1 story, basement, brick, stone, plain found., day labor. $150,000. R. C. Gorrani, 175 Green St., Worcester, Mass., archt. Noted Mar. 12.

Pa., California—See "Schools."

R. I., Providence—St. Mathew's Roman Catholic Parish, c/o A. J. Murphy, archt., 25 Fenner St., bids about May 1, 1 and 2 story, basement, brick, stone church, school, plain found., Park and Elmwood Aves. $150,000. Noted Mar. 26.

SCHOOLS

PROPOSED WORK

Calif., Riverside—Bd. of Regents University of California, Westwood, plans by G. S. Wilson, 3646 West 9th St., rein.-con. college buildings at Citrus Experiment Station. $150,000.

Conn., Hamden—Town, School Bd., plans new high school, Dixwell Ave. $500,000 bond issue authorized. Architect not selected.

Conn., Middletown—State, C. Penniman, Lone Lane Farm, plans by Towner & Sellew Associates, 329 Main St., brick, steel, rein.-con. school, incl. cottages, administration school, boiler and service units, Lone Farm. $175,000. Taking bids for cottages only. Noted Jan. 22.

Conn., Wallingford—Choate School, G. C. St. John, headmaster, plans by Polhemus & Coffin, 232 Madison Ave., New York, brick, stone, concrete, winter exercise and gymnasium building. $200,000. **Maturity June or later.** H. W. Andrews, c/o owner, engr. Noted June 26.

Ill., Evanston—James Gamble Rogers, archt., 154 East 46th St., New York, bids early in May, general contract 2 story, 40 x 200 ft. library, for Northwestern University. $1,000,000. Noted Nov. 20.

Ill., Peoria—Peoria Public Schools, E. C. Fisher, supt., 3 story, basement, rein.-con., brick, stone, incl. shops, science, music, art departments, gymnasium, cafeteria, Warren St. $800,000. **Maturity in late summer.** Hewitt, Emerson & Gregg, Peorial Life Bldg., archts.

Ind., Indianapolis — Butler College, J. W. Atherton, secy., 2 rein.-con., brick dormitories. $400,000. Architect not selected.

Ind., Kokoma—School Comrs. plans by H. P. Bartlett, 1050 North Delaware St., Indianapolis, Junior High School, rein.-con., brick. $150,000.

Ind., St. Meinard—St. Meinard College plans by Crowe & Schulte, 2436 Reading Rd., Cincinnati, O., 4 story, basement, 162 x 264 ft., rein.-con., marble, stone college, incl. auditorium, stage, motion picture projection, recreation hall, bakery. $500,000.

Mass., Amherst—Amherst College, Bd. Trustees, plans by McKim & White, 101 Park Ave., New York, 1 story, 65 x 135 ft., brick, steel theatre. $150,000. **Maturity about June.** W. W. Chapin, 110 East 42nd St., New York, structural engr.

Mass., Andover—Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, school, Dascomb Rd. and Lowell St. $150,000 or more. Architect not selected.

Mass., Barnstable—Town, C. A. Crocker, chn. Bd. Selectmen, grade school, Centerville Sect. $150,000 or more. Architect not selected.

Mass., Boston—City, Dpt. School Buildings, soon takes bids 2 story, basement, brick, limestone, school, plain found., Hurlcroft Ave. and Alicia Rd., Dorchester. To exceed $150,000.

Mass., Boston—City, Dpt. School Buildings, plans by C. R. Greco, 11 Beacon St., and soon takes bids 3 story, basement, irregular sized, brick, limestone, steel, plain found., Charter St., Eliot Hancock Dist. $400,000. Noted Feb. 26.

Mass., Braintree—Town, Bd. Selectmen, Junior High School, North Braintree Sect. $150,000 or more. Architect not selected.

Mass., Norwood—Town, W. L. Grant, supt., plans by W. G. Upham, Bigelow Bldg., and soon takes bids altering and constructing 2 story, basement, brick, stone addition to Senior High School, plain found. $150,000. Noted Feb. 19.

Mass., Plymouth—Town, School Building Comn., new sketches by F. I. Cooper Corp., 47 Winter St., Boston, altering and constructing 3 story, basement, brick addition to Junior and Senior High School, Lincoln St. $250,000. Noted Apr. 17, 1930.

N. H., Warner—Town, Bd. Selectmen, altering and constructing 2 story, brick high school addition. $125,000-$150,000. Architect not selected.

N. J., Bergenfield—Bd. Educ., C. S. Dicker, dist. clk., 45 Smith Ave., plans by A. Dore, 173 Main St., Hackensack, 2 story, basement, brick, steel, rein.-con., southwestern section boro. $152,000.

N. J., Bordentown—Dpt. Institutions & Agencies, State Office Bldg., Trenton, sketches by Guilbert & Betelle, 20 Branford Pl., Newark, 2 story, basement, brick, steel industrial school. $150,000 or more. Noted Dec. 11.

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N. J., Freehold—Freehold Military Academy, 2 story, basement, brick, steel school. $200,000. **Maturity after July 1.** J. Eberson, 370 Lexington Ave., New York, archt. Noted Apr. 9.

N. J., Newark—Bd. Educ., City Hall Annex, sketches by Guilbert & Betelle, 20 Branford Pl., Junior-Senior High School, 3 story, basement, brick, steel, rein.-con., Chancellor Ave. $1,000,000.

N. J., Paterson—State Bd. Educ., State House, Trenton, sketches by Guilbert & Betelle, 20 Branford Pl., Newark, brick, steel, state normal school, Almshouse site, $400,000. Noted Dec. 11.

N. J., Springfield—Bd. Educ., Short Hills, revised sketches by J. T. Simpson, 45 Walnut St., Newark, 2 story, basement, brick, steel, rein.-con. high school. $150,000. Noted Mar. 12.

N. J., Trenton—Dpt. Institutions & Agencies, State House Annex, sketches by Guilbert & Betelle, 20 Branford Pl., Newark, 2 story, basement, brick, steel school for deaf. $150,000. Noted Dec. 4.

N. Y., Brooklyn—Bd. Educ., 500 Park Ave., New York, plans by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., P. S. 240, Avenue I and East 31st St. $700,000.

N. Y., Peekskill—Mohegan Lake School, c/o W. S. Bainbridge, altering and constructing new buildings. To exceed $150,000. **Maturity indefinite.**

Okla., Chickasha — Bd. of Affairs, Capitol Bldg., Oklahoma City, sketches brick dormitory, plain found., on campus Oklahoma College for Women. $200,000 appropriated.

Pa., Montoursville—Montoursville School Bd. sketches by Linthicum & Linethcum, Wash., D. C., high school, incl. auditorium. To exceed $150,000.

Pa., Springdale—Bd. Educ., B. D. Remaley, secy., 511 Roslyn Ave., plans by J. H. Phillips, Wabash Bldg., Pittsburgh, 2 story, part basement, brick, steel high school on 2 acre site, Colfax St. near Ridge Ave. $150,000.

Pa., State College—Pennsylvania State College sketches college buildings, incl. domestic science, dairy, also sewerage system. $940,000. College trustees will select architect.

Tex., Dumas—Bd. Educ. plans by G. A. Carlander. Fisk Medical & Professional Bldg., Amarillo, and soon takes bids fireproof school. $150,000. Noted Mar. 19.

Ont., Guelph — Dpt. P. Wks., Parliament Bldgs., brick, stone, concrete additions, improvements to Ontario Agricultural College, incl. administration and students building, electric substation, power house, water tower, watermains. $260,000. Private plans.

Ont., Kenora—Bd. Educ. plans by Northwood & Chivers, Royal Bank Bldg., Winnipeg, Man., 2 story, basement, brick, concrete, stone high school. $150,000.

Ont., Sudbury—Bd. Educ., 19 Durham St. N., plans by P. J. O'Groman, Mackie Bldg., and soon takes bids 2 story, basement, brick, rein.-con., steel additions to St. Thomas, Nolin and St. Louis de Gonzaque Schools, plain founds. $175,000.

Ont., Woodstock—Bd. Educ., 33 Wellington St. N., plans by S. B. Coon & Son, 4 St. Thomas St., Toronto, and soon takes bids, 3 story, basement, brick, stone, rein.-con., steel collegiate and vocational school, incl. auditorium, gymnasium, plain found., Hunter St. $190,000.

BIDS ASKED

Ky., Louisville—Apr. 24, by Bd. Educ., 8th and Chestnut Sts., Oakdale Elementary School, irregular sized, rain.-con., brick, steel, Denmark, Brentwood and 8th Sts. $250,000. J. M. Cooley, c/o owner, archt.

La., New Orleans — Apr. 21, by Orleans School Bd. 3 story, 86 x 171 ft., brick, stone school, rein.-con. found., Freret St. $200,000. E. A. Christy, City Hall Annex, archt. Noted Mar. 19.

Md., Baltimore — Apr. 29, by Bd. Awards, Forest Park Junior High School, 3 story, basement, brick, structural steel, concrete, Garrison Ave. and Barrington Rd. $400,000. Smith & May, Baltimore Trust Bldg., archts. Kubitz & Koenig, Emerson Tower, engrs. Steam heating, ventilating, plumbing, electric wiring, painting, glazing, hollow metal work, metal wnidows, steel sash and frames, cut stone hollow partitions, waterproofing, radial brick chimney, caulking, dampproofing, kalamein fire doors, slag roofing, sheet metal, millwork, fly screens, hardware, terrazzo, etc. Cafeteria equipment, stage curtain, gymnasium equipment and shades reserved.

Me., Gorham—Apr. 22, by State Normal School, W. E. Russell, principal, and R. Mayo, archt., 465 Congress St., Portland, 1 and 2 story, basement, 60 x 180 ft., brick, stone, steel, gymnasium, auditorium, plain found. $150,000. Noted Mar. 26.

Mass., Arlington—Apr. 17, by Town, School Comn., and R. T. Jackson, archt., 44 School St., 2 story, basement, brick, limestone, steel, plain found., Brattle Sect., Eastern Ave. $225,000. Fay, Spofford & Thorndike, 44 School St., Boston, engrs.

Mass., Groton—Apr. 18, by Groton School, E. Peabody, headmaster, and D. H. Chandler, archt., 75 Newbury St., Boston, altering and constructing 2 and 3 story, basement, irregular sized, brick additions to Brooks House and Hundred House, plain founds. $150,000.

Mass., Medford (br. Boston)—Apr. 23, by Tufts College, J. A. Cousens, pres., and Andrews, Jones, Biscoe & Whittemore, archts., 50 Congress St. Boston, 2 and 3 story, basement, irregular sized, brick, steel physical education building, gymnasium, plain found. College Grounds. $750,000. J. R. Worcester Co., 79 Milk St., Boston, engrs. Noted Mar. 26.

Mass., Springfield—City, Mayor's Office, bids about May 1, altering and constructing 3 story, basement, irregular sized, brick, stone, concrete addition to Technical High School, incl. 2 gymnasiums. $400,000. E. C. and G. C. Gardner, 33 Lyman St., archts. Noted Mar. 5.

Mass., Weston — Cambridge School, J. R. French, headmaster, 36 Concord Ave., taking bids 2 and 3 story, basement, administration building, dormitory, gymnasium, plain found., Trapelo Rd. and Enclave St. $150,000 or more. Kilham, Hopkins & Greeley, 9 Park St., Boston, archts. Noted Apr. 9.

Mich., Manistique—Apr. 28, by A. G. Reilly, secy. Bd. Educ., 2 story grade school, and 3 story high school, each brick, steel, rein.-con., incl. gymnasiums, plain founds. $350,000. R. V. Gay, St. Johns, archt. Noted Feb. 19.

Mich., Muskegon—Apr. 23, by H. H. Linn, bus. mgr., Bd. Educ., 2 story, basement, brick, rein.-con., steel school, plain found. $150,000. E. E. Valentine, Hackley Union Bank Bldg., archt.

N. J., Haledon (mail Paterson)—Bd. Educ., J. W. Grimshaw, pres., 305 Haledon Ave., bids about May 1, general contract 2 story, basement, brick, steel, Barbour St. $150,000. J. C. Van Vlandren, 140 Market St., archt. Noted Feb. 5.

N. J., Irvington (br. Newark)—Bd. Educ., 1253 Clinton Ave., bids about May 15, altering and constructing 2 story, basement, brick, steel addition, Grove St. $250,000. Schneider, Kleeman & Werther, 1007 Broad St., Newark, archts. Noted Apr. 2.

N. J., Jamesburg—Bd. Educ. bids about May 1, 2 story, basement, 85 x 185 ft., brick, steel, rein.-con. high school, Davison Estates. $150,000. J. N. Pierson & Son, 198 Jefferson St., Perth Amboy, archts. Noted Mar. 5.

N. J., Peapeck—Bd. Educ., Peapack-Gladstone Boro., Main St., bids about May 1, 2 story, basement, brick, steel school addition. $150,000. A. Merchant, 1 El Row, New Brunswick, archt. Noted Mar. 19.

Pa., Wellsboro — Wellsboro School Bd. bids about May 1, Junior and Senior High School, 3 story, basement, incl. auditorium, gymnasium, offices, $175,000. W. D. Shollenberger, Williamsport, archt.

CONTRACTS AWARDED

Calif., Pasadena — California Institute of Technology, 4 story, basement, rein.-con. laboratory, to W. C. Crowell, 495 South Bway., $150,000. Noted Jan. 22.

Calif., Santa Barbara—Bd. Educ., general contract 2 story, rein.-con. school, to C. N. Swenson, 355 Stockton Ave., San Jose, $417,176. Noted Mar. 12.

Conn., New Haven—Yale University, A. Farnum, constr. supt., brick, stone units at New Haven Hospital for Yale Medical School, incl. women's unit and surgical unit, Kimberly Ave., to Sperry & Treat, Kimberly Ave. Est. exceeds $150,000.

Ga., Savannah—Chatham Co. Bd. Educ., O. E. Strong, supt., Junior High School, to Artley Co., 504 East Bay St. Est. $141,000. Noted Jan. 1.

Ill., Chicago—Catholic Bishop of Chicago, 719 Cass St., general contract 2 story, basement, auditorium and gymnasium, balcony, at St. Ignatius School, 1300 Loyola Ave., to W. J. Lynch Co., 844 Rush St. Est. $175,000.

Ind., St. Meinard — St. Meinard College, E. Beirheide, pastor, general contract brick, rein.-con., hollow tile college, chapel, to Tri-State Contg. Co., 522 Market St., Evansville. Est. $150,000. Noted Mar. 19.

La., New Orleans—A. A. Vidrine, Charity Hospital, general contract Medical Center Building, 10 story, 54 x 200 ft., rein.-con., brick, limestone wood pile found., to R. P. Farnsworth & Co., Maritime Bldg., $529,189; electrical wiring system, apparatus, to Hart Enterprise, Electric Co., 826 Baronne St., $59,500; mechanical equipment, heating, and plumbing systems, to Sciambra & Masino, Inc., 636 North Broad St., $127,890; 3 elevators, to Otis Elevator Co., 852 Carondolet St., $57,511 for Louisiana State Medical College. Grand total $774,090. Noted Mar. 5.

Mass., Townsend — E. S. Bagler, chn. Bd. Selectmen, 2 story, basement, 120 x 130 ft., brick, stone grade and high school, plain found., State Rd., Main and Centre Sts., to W. J. Handley Co., 280 Main St., Fitchburg. Est. $150,000. Noted Mar. 26.

Neb., Crete—Doane College, E. B. Dean, pres., 3 story, basement, 49 x 201 ft., brick, rein.-con., stone dromitory, to Olson Constr. Co., 704 Stuart Bldg., Lincoln. Est. $175,000.

Minn., Minneapolis—Bd. Educ., 305 City Hall, general contract 2 story, basement school, Nicollet Ave. between 49th and 50th Sts., to Midwest Contg. Co., 612 Builders Exch. Bldg., $384,389. Noted Mar. 19.

N. J., Phillipsburg—Bd. Educ., High School, general contract 2 story school, to M. A. Carty, 78 Summit Ave., plumbing, to J. M. O'Donnell, Quakertown, Pa.; heating, to Burns Lane & Richardson Co., 301 Burnet St., New Brunswick; electrical work, to W. A. Tydeman, Inc., Easton, Pa. Est. $150,000. Noted Feb. 19.

N. Y., Brooklyn—Bd. Educ., 500 Park Ave., New York, general contract P. S. 229, to G. F. Driscoll Co., 548 Union St., $294,700. Noted Mar. 26.

N. Y., New York—Bd. Educ., 500 Park Ave., New York, general contract P.S. 196, to C & W

Schools (Continued)

constr. Co., 353 East 149th St., $271,900. Noted Feb. 5.

N. Y., Queensboro Hill—Bd. Educ., 500 Park Ave., New York, general contract P.S. 120, to Crest Eng. Co., 5 Columbus Circle, New York, $274,700. Noted Feb. 19.

O., Cincinnati—Garber & Woodward, archts., 616 Walnut St., 3 and 6 story, basement, 60 x 160 ft., rein.-con., brick botany and zoology building, plain founds., to Chappelear Constr. Co., 622 Bway., for University of Cincinnati. $302,722. Noted Mar. 5.

O., Cleveland—John Carroll University, J. J. Bernet, chn. Building Com., West 3rd St. and Carroll Ave., general contract 89 x 248 ft. administration building, 125 x 181 ft. and 177 x 178 ft. dormitories, 104 x 128 ft. cafeteria and gymnasium, 83 x 152 ft. chemistry building, 70 x 310 ft. physics and biology building, 70 x 181 ft. chapel, and 46 x 111 service building, all brick, stucco, steel, concrete Washington Blvd., to Hunkin-Conkey Constr. Co., Newman-Stern Bldg. Est. $2,500,000. Noted Feb. 19.

Pa., California — Methodist Episcopal Congregation, H. A. Price, pastor, general contract 3 story, basement, 82 x 127 ft., brick, hollow tile, limestone educational and recreation building, incl. bowling alley, kindergarten, scouts room, chapel, parish hall, to Brownsville Constr. Co., Coal Rd., Brownsville; plumbing and heating, to Regan & Hormel, Charleroi; electric wiring to Beachley & Hornbake, Brownsville. Est. $150,000. Noted Feb. 19.

Ore., Portland—Hill Military Academy, school, to Austin Co., Euclid Ave., Cleveland, O. Est. $300,000.

THEATRES

PROPOSED WORK

Calif., Los Angeles—United Artists of California, 931 South Bway., plans by Walker & Eisen, Pacific Bldg., rein.-con. theatre, Whittier Blvd. $150,000.

Calif., Richmond—United Artists of California, 931 South Bway., Los Angeles, sketches by Walker & Eisen, Western Pacific Bldg., Los Angeles, Class A rein.-con. theatre, Macdonald Ave. $150,000.

Ind., St. Meinard—See "Schools."

N. Y., New York—F. H. T. Holding Corp., H. Trub, pres., 309 West 23rd St., bids after May 15, general contract altering theatre, store, 302 West 24th St. $350,000. T. W. Lamb, 701 7th Ave., archt. Noted Apr. 2.

Va., Charlottesville—Rapp & Rapp, archts., Paramount Bldg., soon lets contract New York theatre, for Meyer & Engel, Charlottesville, $350,000. Paramount Publix Theatres, Inc., Paramount Bldg., New York, lessee. Noted Apr. 2.

BIDS ASKED

Calif., Pasadena — Walker & Eisen, archts., Western Pacific Bldg., Los Angeles, taking bids 1 story, 65 x 166 ft., rein.-con. theatre, 1,000 seating capacity, South Colorado St., for First Trust & Savings Bank.

CONTRACTS AWARDED

Ill., Chicago—Publix-Balaban & Katz Corp., 175 North State St., masonry contract superstructure 1 story, 243 x 265 ft., 4,000 seating capacity rein.-con. brick, steel theatre, to Paschen Bros., 33 North La Salle St. Est. $1,500,000. Noted Nov. 20.

N. Y., Scarsdale—Scarsdale Amusement Co., J. and I. Rosenthal, props., general contract 140 x 192 ft. theatre, to Turner Constr. Co., Graybar Bldg., New York.

O., Elyria—Paramount Publix Theatres, Inc., S. Katz, pres., 43rd St. and Bway., New York, 1 story, basement, brick, steel, concrete, to Kaiser-Ducett Co., Rialto Square Bldg., Joliet, Ill. Est. $250,000.

BANKS

BIDS ASKED

N. J., Newark—A. S. Miller, archt., 1774 Carroll St., Brooklyn, N. Y., bids about June 1, general contract 2 story, 50 x 105 ft., brick, steel bank, Clay and Broad Sts., for S. D. Auria & Sons, 139 7th Ave. $150,000. Noted Mar. 19.

N. J., Paterson—Bway. Bank & Trust Co., 120 Bway., bids about May 15, general contract 2 story, basement, 80 x 100 ft. brick, steel, rein.-con., Bway. and West Bway. $150,000. H. B. Crosby & A. E. Sleight, 125 Ellison St., archts. Noted Feb. 20.

CONTRACTS AWARDED

N. Y., New York—East River Savings Bank, 295 Bway., altering and constructing addition, 96th St. and Amsterdam Ave., to F. T. Ley Co., 578 Madison Ave. Est. $150,000. Bids will be taken about May 1 on steel, other separate contracts.

OFFICES

PROPOSED WORK

Ia., Sioux City—Lytle Constr. Co., C. F. Lytle, pres., 504 Nebraska St., plans by K. E. Westerlind, Badgeion Bldg., 8 story, basement, 75 x 150 ft., probably rein.-con., brick office building, 5th and Pierce Sts. $750,000. **Maturity about June 1.** Noted Nov. 20, under "Contracts Awarded."

Mass., Springfield—Society for Prevention of Cruelty to Animals, F. Rawley, 180 Longwood Ave., Boston, and Putnam & Cox, archts., 114 State St., Boston, soon lets contract 2 story basement, brick, office and animal ward buildings, plain found., Bliss St. $150,000. Noted Jan. 8.

N. J., Jersey City—Springarn Realty Co., J. Springarn, pres., 591 Summit Ave., 9 story, basement, 100 x 120 ft., brick, steel, office, store, Newark and Oakland Aves. $750,000. Project in abeyance. Noted Mar. 5.

N. Y., New York—O. R. Manowaski, c/o Hotel Roosevelt, 45th St. and Madison Ave., 47 story office, store, 441 5th Ave. To exceed $1,500,000. **Maturity in September.** Jardine, Murdock, & Wright, 347 Madison Ave., archts. Noted Feb. 19.

BIDS ASKED

N. J., Westfield—Elizabethtown Consolidated Gas Co., 16 West Jersey St., Elizabeth, taking bids general contract 3 story, basement office, 1 story, basement garage, brick, steel, Crossway Pl. and West North Ave. $150,000. Private plans.

N. Y., Syracuse—Syracuse Lighting Co., South Warren St., taking bids 7 story, basement, 87.5 x 208 ft. office, Erie Blvd. $750,000. M. L. King, Dennison Bldg., archt.

CONTRACTS AWARDED

Ga., Atlanta—United Corp., Candler Bldg., two 50 x 170 ft., rein.-con. top addition, Broad St., to Griffin Constr. Co., 452 Spring St., $200,000.

N. J., Newark—Bratler & Pollak, 972 Broad St., general contract altering theatre into office, store, Springfield Ave., to Fatzler Co., 11 Hill St. Est. $150,000.

STORES

PROPOSED WORK

Conn., Danbury—Hayman Realty Co., 46 White St., soon lets contract brick, steel store, office building, White St., $125,000-$150,000. E. B. Caldwell, Jr., 886 Main St., Bridgeport, archt.

O., Massillon—Albrecht & Wilhelm, archts., 1900 Euclid Bldg., Cleveland, soon lets contract 2 story, basement, brick, steel, concrete department store, for Gensemer Bros., Inc., D. D. Gensemer, Massillon. $200,000.

Tex., Beaumont—W. W. Kyle, plans by Babin & Neff, 1 and 2 story, 50 x 300 ft., stone, steel store, Liberty Ave. and Orleans St. $200,000.

BIDS ASKED

Calif., Sacramento—J. Fleming, archt., 1031 South Bway., Los Angeles, taking bids 2 story, basement, rein.-con. department store, for S. J. Kress Co., Western Pacific Bldg., Los Angeles. $250,000.

N. Y., Brooklyn—G. and E. Blum, archts., 415 Lexington Ave., New York, taking bids on separate contracts 4 story store, office, Pearl, Fulton and Willoughby Sts., for Estate of Gertrude Prince Coombs, 44 West 77th St., New York. $150,000. Noted Apr. 2.

PUBLIC

PROPOSED WORK

Calif., San Jose—JAIL—Santa Clara Co. plans by Binder & Curtis, 35 West San Carlos St., fireproof. $150,000. Noted Jan. 30, 1930.

N. J., Caldwell — BORO HALL — Bd. Boro Council, Boro Hall, 2 story, basement, brick, steel. $200,000. Project in abeyance. Guilbert & Betelle, 20 Branford Pl., Newark, archt. Noted Mar. 26.

N. C., Raleigh — PRISON — Chairman State Prison Bd. $400,000. Architect not selected.

Okla., Oklahoma City—OFFICE—Bd. Affairs, Capitol Bldg., sketches office building, on State Grounds. $750,000 appropriated. Architect not selected.

Tex., Wellington—COURT HOUSE—Collingsworth Co. plans by Berry & Hatch, 414 Eakles Bldg., Amarillo, 2 story, basement court house, $175,000. Noted Mar. 12.

BIDS ASKED

Ala., Wetumpka—COURT HOUSE—Apr. 30, by G. H. Howard, judge of Probate, courthouse, for Elmore Co. Warren, Knight & Davis, Protective Life Bldg., Birmingham, archts.

Mo., St. Louis—POLICE STATION, etc.—Bd. Police Comrs., 12th Blvd. and Clark Ave., taking bids 2 story, basement, brick, rein.-con., stone police station, garage, Kansas Ave. and Colorado St. $150,000. Klipstein & Rathmann, 316 North 8th St., archts. Noted Feb. 26.

N. J., Irvington (br. Newark)—POLICE HEADQUARTERS—Bd. Town Comrs., Town Hall, bids about May 15, general contract 2 story, basement, brick, steel addition, Washington Ave. $150,000. G. F. Lederer, 2 Union Ave., archt. Noted Apr. 2.

N. Y., Brooklyn — MUSEUM — Brooklyn Institute of Arts & Sciences, 45 Plaza St., and H. Hesterberg, pres. Brooklyn Boro. Boro Hall, bids about June 1, altering museum, Eastern Parkway and Washington Ave. $265,000. McKim, Meade & White, 101 Park Ave., New York, archts. Noted Apr. 2.

N. Y., New York—COURT HOUSE—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., bids about June or later general contract 14 story county building, Grand Concourse between 158th and 161st Sts. $7,000,000. J. H. Freedlander, 681 5th Ave., and M. Hausle, 3307 3rd Ave., archts. Noted Apr. 17, 1930.

CONTRACTS AWARDED

N. Y., New York—MUSEUM—Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, general contract South Oceanic Wing, American Museum of Natural History, to A. I. Kraft, 1560 Bway., $727,000. Noted Mar. 19.

UNCLASSIFIED

PROPOSED WORK

Calif., Los Angeles—AUTO SALES—E. L. Cord, c/o A. C. Martin, archt., Higgins Bldg., 4 and 5 story, 140 x 195 ft., steel frame Class A, Wilshire Blvd. $250,000.

Mass., Springfield—SALES, etc.—Cadilac La Salle Co., 563 State St., N. J. Duryea, brick, steel sales and office building addition, State St. $150,000. Private plans.

Mass., West Roxbury (sta. Boston)—HOME—Altenheim, under direction of German Ladies Aid Society, S. Hauk, pres., 2222 Centre St., plans by Funk & Wilcox, 26 Pemberton Sq., Boston, and soon takes bids altering and constructing 3 story, basement, brick, tile, stucco addition, plain found., for Altenheim Home for Aged, Centre St. $150,000 or more.

N. Y., New York—RESTAURANT, etc.—Earl Carroll and Seven Fifty-Five 7th Ave. Corp., plans by G. E. Keister, 56 West 45th St., 40 story restaurant and commercial building, vicinity 7th Ave. and 50th Sts. To exceed $1,000,000. **Maturity indefinite.**

BIDS ASKED

Mich., Ishpeming—INN—Ishpeming Hotel Co., G. R. Jackson, in charge taking bids 3½ story, basement, brick. $175,000. J. H. Ritchie & Associates, 250 Stuart St., Boston, Mass., archts.

N. J. Hopatcong—EXCHANGE—New Jersey Bell Telephone Co., 540 Broad St., Newark, bids about June 1, general contract 1 story, basement, brick, steel. $150,000. H. B. Brady, Inc., 333 North Broad St., archt. Noted Apr. 2.

R. I., Providence—EXCHANGE—Apr. 21, by New England Telephone & Telegraph Co., 245 State St., Boston, Mass., 2 story, basement, 60 x 120 ft., brick, steel, stone, Broad and Eddy Sts. $150,000. Densmore, LeClear & Robbins, 31 St. James Ave., Boston, Mass., archts. Noted Mar. 12.

CONTRACTS AWARDED

Calif., Bakersfield—MOTOR INN—National Motor Inns, Inc., 1035 Russ Bldg., San Francisco, inn, incl. administration building, kitchen, dining room, service station, swimming pool, 120 guest rooms (cottage type), to G. L. Leiter, 3700 West St., Oakland, $180,000.

Calif., Fresno — MOTOR INN — National Motor Inns, Inc., 1035 Russ Bldg., San Francisco, inn, incl. administration building, kitchen, dining room, service station, swimming pool, 120 guest rooms (cottage type), to G. L. Leiteh, 3700 West St., Oakland, $180,000.

Calif., Los Angeles—MOTOR INN—National Motor Inns, Inc., 1035 Russ Bldg., San Francisco, inn, incl. administration building, kitchen, dining room, service station, swimming pool, 120 guest rooms (cottage type), to G. L. Leiter, 3700 West St., Oakland, $180,000.

Calif., Paso Robles—MOTOR INN—National Motor Inns, Inc., 1035 Russ Bldg., San Francisco, inn, incl. administration building, kitchen, dining room service station, swimming pool, 120 guest rooms (cottage type), to G. L. Leiter, 3700 West St., Oaklond, $180,000.

Calif., Sacramento—MOTOR INN—National Motor Inns, Inc., 1035 Russ Bldg., San Francisco, inn, incl. administration building, kitchen, dining room, service station, swimming pool, 120 guest rooms (cottage type), to G. L. Leiter, 3700 West St., Oakland, $180,000.

Calif., Santa Barbara—MOTOR INN—National Motor Inns, Inc., 1035 Russ Bldg., San Francisco, inn, incl. administration building, kitchen, dining room, service station, swimming pool, 120 guest rooms (cottage type), to G. L. Leiter, 3700 West St., Oakland, $180,000.

Conn., Greenwich — CONVALESCENT HOME—St. Luk's Convalescent Home, C. F. Glover, supt., 2 story, basement, children's pavillion, brick, to Dall-Hayden-Treat Co., Grand Central Terminal, N. Y. Contractor taking bids separate contracts. Noted Mar. 26.

Ill., Peoria — HOME — Christian Buehler Memorial, 103 West High St., c/o E. J. Cashin, Old Peoples Home, 3 story, basement, 160 x 200 ft., brick, rein.-con. (ribbed slab), to V. Jobst & Son, Peoria. Est. $200,000. Noted Mar. 26.

Mass., Brighton — HOME — Mowell & Rand, archts., 21 School St., Boston. 2 story, basement, brick, stone addition, to F. C. Alexander Co., 294 Washington St., Boston, for Florence Crittenden League of Compassion, Inc., L. Higgins, chn. building comm., 88 Tremont St., Boston. Est. $150,000. Noted Mar. 19.

Industrial Buildings

FACTORIES AND MILLS

PROPOSED WORK

Calif., Redwood City—ICE MANUFACTURING PLANT—Union Ice Co., 354 Pine St., San Francisco, sketches probably rein.-con., on 100 x 126 ft. site, Brewster Ave.

Ind., St. Meinard—See "Schools."

Minn., South St. Paul—FACTORY—Swift & Co., South St. Paul, plans by own Architectural Dept., 33 South Clark St., Chicago, Ill., 4 story, 125 x 224 ft. repair and service garage.

N. J., Hoboken—FACTORY—Garsten Realties Co., J. Ramanno, pres., 1827 Bergen Turnpike, North Bergen, revised sketches 1 story, base-

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Factories and Mills (Continued)

ment, brick, steel, Madison, Jefferson, Sts. between 14th and 15th Sts. $40,000 or more. Private plans. Noted Jan. 22.

N. J., Jersey City — CHEMICAL PLANT — Clifton Chemical Co., Inc., 246 Front St., New York, 2 story, basement, brick, steel, on 75 x 100 ft. site, 64-68 Essex St. $40,000. **Maturity indefinite.** Architect not selected.

N. J., Jersey City—ENGINE PLANT—O. L. Wutzdorff, archt., 147 Summit Ave., Union City, soon lets contract 1 story, basement, brick, steel auto engine remodeling plant, Tonnelle Ave. and Allen St., for Montgomery Cylinder & Grinding Co., 678 Montgomery St., Est. $40,000. Noted Mar. 26.

N. J., Paterson — SILK MILL—Canova & Simone, 182 Cedar St., silk mill, $40,000. Project in abeyance. Lockwood, Greene & Co., Pershing Sq., New York, engrs. Noted Mar. 19.

N. Y., Brooklyn—DYE FACTORY—T. Lupo, 913 Grand St., sketches by M. Klein, 65 Court St., 1 story, 125 x 175 ft. manufacturing plant, Waterbury and Meadow Sts. $40,000.

O., Akron—OIL BULK PLANT—Sun Oil Co., W. A. Courtney, 1608 Walnut St., Phila., Pa., soon lets contract brick, steel, concrete oil bulk plant, incl. pump house, office, garage, loading rack and steel plate tanks for storage. $50,000. Private plans.

O., Youngstown—OIL BULK PLANT—Sun Oil Co., W. A. Courtney, 1608 Walnut St., Phila., Pa., soon lets contract brick, steel, concrete oil bulk plant, incl. pump house, office, garage, loading rack, steel plate tanks. $40,000. Private plans.

Ont., Hamilton — MANUFACTURING, etc.— Anchor Cap & Closure Co., 22 Queen's Blvd., Long Island City, N. Y., A Stewart in charge, or J. O. Deegan, 275 Wallace Ave., Toronto, manufacturing and harbor development.

Ont., Windsor—CANNING PLANT—Minnesota Valley Canning Co., Leseur, Minn., through D. Wall, 1020 Ouellette Ave., Windsor, Canadian representative, canning plant, near here. $1,000,000.

BIDS ASKED

N. J., Paterson—FACTORY—Lee & Hewitt, archts., 152 Market St., bids about May 15, on revised plans 2 story, basement, 65 x 165 ft., brick, steel, for J. S. Royal, c/o architect. $40,000. Noted Jan. 15.

CONTRACTS AWARDED

Conn., Newington—Keeney Mfg. Co., Main St., 1 story, basement, 45 x 120 ft., brick, steel, concrete addition, to R. G. Bent Co., Inc., 93 Edwards St., Hartford. Est. $40,000, incl. equipment.

Ind., Evansville — PLANT — Mead-Johnson Co., 200 South St. Joseph St., 2 story, basement, 40 x 65 ft., brick, rein.-con. laboratory, St. Joe Ave. and Ohio St., to Hoffman Constr. Co., Union Bank Bldg. Est. $42,000.

Ia., Harper — BOOSTER STATION — Continental Constr. Co., c/o H. L. Doherty & Co., 88 x 146 ft. compressor station, 60 x 122 ft. auxiliary building, storage warehouse, shops structural steel garages with concrete floors, 10 frame cottages, 80 ft. water lower, laying 8 mi. various size pipe line, unloading, placing station equipment, to Lanning Constr. Co., Newton. Est. $200,000.

Ia., Iowa City — MECHANICAL ENGINEERING LABORATORY—Iowa State University, c/o State Bd. Educ., State House, Des Moines, general contract 2nd and 3rd floor of building to be 3 story, 72 x 150 ft., concrete, steel, Bedford stone, to T. Stark Constr. Co., 118 South 11th St., Cedar Rapids, $38,400; structural steel, to Des Moines Steel Co., 421 Southwest 4th St., Des Moines.

La., Baton Rouge — STEAM PRODUCTS PLANT—Stone & Webster Corp., 818 Olive St., St. Louis, Mo., will build additional unit to Louisiana Steam Products Plant. Est. $750,000, incl. equipment. Contract awarded for boilers.

Mass., Cambridge — FACTORY — Riverside Boiler Wks., Inc., 50 Harvard St., altering and constructing 3 story, 75 x 105 ft., brick, steel addition, concrete found., to F. Leroy Fox, Inc., 101 Milk St., Boston. Est. $40,000.

Mo., Leeds—CAR ICING PLANT—Mountain Ice Co., c/o City Ice & Fuel Co., W. J. Sinek, vice pres., 33 South Clark St., Chicago, Ill., general contract 2 story, 100 x 100 ft., storage building, 1 story, 60 x 120 ft. ice plant, 2,500 ft. icing platform, 13 ft. wide, on Missouri-Pacific R.R., west of Blue River, to R. S. Blome Co., 1st Natl. Bank Bldg., Chicago, Ill.; ice making machinery, to Ball Ice Machine Co., 126 Chouteau Ave., St. Louis. Est. $350,000.

Mo., St. Louis—NEWSPAPER PLANT—Midwest Industrial Development Co., c/o Illinois Terminal Railroad, A. P. Titus, vice-pres., 314 Shell Bldg., fabrication and delivery 1,000 tons structural steel, for superstructure 5 story, basement, sub-basement, 120 x 168 ft. newspaper plant, to Mississippi Valley Structural Steel Co., 3117 Big Bend Blvd., Maplewood. Total est. $1,500,000. Star Chroncile Publishing Co., 12th and Olive Sts., lessee. Noted Apr. 2.

Mo., St. Louis—PLANT—J. R. Kearny Corp., 4320 Clayton Ave., 3 story, 100 x 105 ft., rein.-con. brick addition, 30,000 sq.ft. floor space, to Humes-Deal Co., 777 Arcade Bldg.; plumbing, to J. Sheehan Plumbing Co., 1609 Olive St.; structural steel, to Mississippi Valley Structural Steel Co., 3117 Big Bend Blvd.; brick work to F. Kirk & Sons, Railway Exch. Bldg.; excavating, to J. E. Connelly Excavating Co., 841 Rosedale Ave.

N. J., New Brunswick—BAKERY—J. Vella, 183 Remsen Ave., general contract 2 story, basement, 30 x 100 ft., brick, steel, to Hub City Constr. Co., Livingston Ave. Est. $40,000. Noted Apr. 2.

O., Cleveland—FACTORY—J. C. Virden Co., J. C. Virden, pres., 6103 Longfellow Ave., 2 story, basement, 35 x 152 ft. addition, to George A. Rutherford Co., 2725 Prospect Ave. Est. $40,000.

Pa., Pittsburgh—MANUFACTURING PLANT—Smith Faris Co. R. L. Smith, pres., 1150 Hodgkiss St., 1 story, basement, 26 x 82 ft., to A. Phillipp, 3122 Bridgton Rd. Est. $40,000. Noted Mar. 19.

Man., Winnipeg—FACTORY—Christie, Brown & Co., Ltd., 192-202 King St., East Toronto, Ont., 1 and 2 story, 135 x 525 ft., brick, steel, concrete, to Hazelton & Walin Ltd., Winnipeg. Total est. $1,000,000. Noted Oct. 23.

GARAGES

PROPOSED WORK

Calif., Los Angeles—Downtown Business Men's Assn., plans by S. C. Lee, 2404 West 7th St., & E. T. Heitschmidt, 807 Subway Terminal Bldg., garage, under Pershing Square. To exceed $1,000,000.

Conn., Waterbury—Kaplan Bros., 352 East Main St., revised plans by T. M. Frenet, 69 Center St., 1 story, basement, rein.-con., brick, steel service garage, sales building, concrete found., East Main St. $40,000. Former bids rejected. Noted Mar. 19.

Mass., Pittsfield—J. E. Aubry, Pollack Ave., plans by G. E. Haynes, 29 George St., and takes bids probably in October, 3 story, 105 x 130 ft., brick ramp garage, Summer St. $175,000. Noted Sept. 25, under "Bids Asked."

Mass., Springfield—A. Bondi, 101 Lyman St., 2 story, basement, brick auto sales and service building, Taylor St. $120,000. Architect not selected.

N. J., Passaic—Jersey City & Nutley Bus Co., (Kruger Bros.), 537 Franklin Ave., Nutley, brick, steel garage. $150,000. **Maturity probably soon.**

N. Y., Brooklyn—F. Calabrese, 1612 2nd Ave., New York, sketches by D. S. Lang, 1860 Bway., New York, 1 story, 100 x 110 ft. service garage, Fenimore St. and East Albany Ave. $40,000.

N. Y., Brooklyn—Casper Realty Corp., 6117 4th Ave., sketches by D. S. Lang, 1860 Bway., New York, 1 story, 100 x 100 ft. service garage, 4th Ave. and 63rd St. $40,000.

N. Y., Brooklyn—P. and C. Building Corp., 1630 Carroll St., I. Palatnick, pres., sketches by H. J. Nurick, 44 Court St., 1 story, 100 x 140 ft., brick service garage, Avenue I and East 35th St. To exceed $45,000.

N. Y., Brooklyn—T. L. E. G. Constr. Corp., M. Goodman, pres., 65 Court St., sketches by M. Klein, 65 Court St., 1 story, 98 x 100 ft. service garage, gas station, Oakland and Box Sts. $40,000.

Pa., Oil City—Empire Oil Wks., W. J. Scott, in charge, Reno, plans by Brenot & Hicks, Traymore Bldg., 1 story, 30 x 40 ft. service station, 40 x 120 ft. garage and accessory building, brick, tile, incl. wash racks, greasing pits, office, battery station, floodlighting and electric sign, State and 2nd Sts. $50,000.

Pa., Pittsburgh—L. Slutsky, Stanton Ave., plans by H. Ginsburg, Plaza Bldg., 3 story, 130 x 130 ft., brick, tile, 200 car garage, 3rd Ward. $50,000.

BIDS ASKED

Mass., Newton—Newton Buick Co., R. Dwyer, pres., 371 Washington St., taking bids 1 story, basement, 65 x 105 ft., concrete, service and sales station, 378 Washington St. $40,000. Private plans.

N. Y., Jamaica—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Bakersfield — See "Buildings — Unclassified."

Calif., Fresno—See "Buildings—Unclassified."

Calif., Los Angeles—See "Buildings—Unclassified."

Calif., Paso Robles — See "Buildings — Unclassified."

Calif., Sacramento — See "Buildings — Unclassified."

Calif., Santa Barbara—See "Buildings—Unclassified."

Conn., New London—B. Bottinelli, Broad St., 1 story, 85 x 135 ft., brick, steel garage, Broad St., to Pieretti Bros., Centerbrook. Est. $40,000. Noted Mar. 26.

Mass., Everett (br. Boston)—Standard Oil Co. of New York, Park Sq. Bldg., Boston, service station, concrete lubricating unit, concrete drives, walks, drainage, Bway. and Ferry Sts., to J. W. Ferris Co., Inc., 11 Peabody St., Peabody.

Mass., Falmouth—Cape Cod Auto Co., Inc., F. Young, Jr., mgr., brick, steel, rein.-con. public garage, concrete found., Depot Ave., to J. E. Overy, North Falmouth. Est. $40,000.

N. Y., Jamaica—Wohlbro Impvt. Corp., 149-27 Jamaica Ave., 100 x 104 ft. service garage, auto laundry, Merrick Blvd. and 116th Ave., separate contracts and day labor. $40,000. A. McLean, 149-27 Jamaica Ave., archt. Noted Mar. 26.

SHOPS AND FOUNDRIES

PROPOSED WORK

N. J., East Rutherford—REPAIR SHOP, etc.—Cragi Coal Co., 10 Park Ave., Rutherford, revised plans by L. B. Huesman & J. Dynes, 13 Orient Way, Rutherford, 2 story, basement, 50 x 120 ft., brick, steel repair shop, garage, office, Morton St. $40,000. Former bids rejected. Noted Apr. 9.

N. Y., Tonowanda—FOUNDRY—Lake Erie Eng. Corp., 268 Perry St., Buffalo, soon lets contract 1 story, 115 x 500 ft., brick, steel, Woodward Ave. $80,000. N. H. Sturdy, Chamber of Commerce Bldg., engr.

POWER PLANTS

PROPOSED WORK

Ark., Mammoth Springs—See "Dams."

N. H., Exeter—Exeter Hospital, Prospect Hill, sketches heating plant, laundry building at hospital. $40,000 or more. C. Williams, 370 Newtonville Ave., Newton, Mass., engr.

N. J., Convent Station—Fanning & Shaw, archts., 49 Ward St., Paterson, soon lets general contract 1 and 2 story, basement, 68 x 95 ft., brick, steel, power house, for St. Elizabeth College, Sisters of Charity. $40,000. Noted Apr. 9.

N. J., Kearny (sta. Arlington)—Pub. Serv. Corp. of New Jersey, and Pub. Serv. Gas & Electric Corp. (subsidiary), Terminal Bldg., Newark, soon award contract for equipment for 75,000 kw. electric generating unit (steam turbine). Exceeds $1,000,000. United Engineers & Constructors, 112 North Broad St., Phila., Pa., in charge of construction.

Ont., Guelph—See "Schools."

Ont., Hamilton — Hydro-Electric System of Hamilton, 12 King St. E., plans by W. J. Walsh, Terminal Bldg., 1 or 2 story, brick, stone, steel, concrete sub-station. $150,000. E. I. Sifton, 12 King St., engr. Noted Feb. 5.

BIDS ASKED

N. Y., Dongan Hills — Apr. 17, by Dpt. Hospitals, J. G. W. Greeff, comr., Municipal Bldg., New York, installing 50 ton carbon dioxide compressor, direct connected to steam engine, incl. connections to present refrigerating machines in power house, Sea View Hospital.

Utah, Logan—City Council taking bids 600 kw. capacity, diesel engine for stand-by unit for present municipal lighting plant. $65,000. H. C. Maughan, supt. Electric Light Plant Dpt.

CONTRACTS AWARDED

Calif., Pasadena—City Directors, 25,000 kw. steam turbine electric generator for municipal power plant, to Allis-Chalmers Mfg. Co., Rowan Bldg., Los Angeles, $397,900. Noted Mar. 5.

N. H., Exeter—Phillips Exeter Academy, L. Perry, principal, and R. D. Kimball Co., engrs., 6 Beacon St., Boston, Mass., 1 story, basement, brick, steel, rein.-con. central heating plant, to J. Gascoigne & Co., Inc., 6 Beacon St., Boston, Mass. Est. exceeds $40,000. Noted Mar. 26.

N. J., Burlington—Pub. Serv. Corp. of New Jersey, Terminal Bldg., Newark, extending building to United Engineers & Constructors, 112 North Broad St., Phila., Pa. Soon purchases mercury boiler, mercury turbine, 2 mercury condenser boilers. Total $9,500,000.

Tex., Fritch—Continental Constr. Co., c/o Contractors, representing Cities Service Co., 60 Wall St., New York, Insull & Son, Co., Inc., 111 Bway., New York, and 20 North Wacker Dr., Chicago, Ill., et al, awarded contract for compressor plant, 12 units, 1,250 hp. each, to provide pressure through 1,000 mi. of natural gas pipe line between Texas Panhandle and Oklahoma, Kansas, Nebraska, Iowa and Chicago, Ill., to Geo. Siedhoff Constr. Co., Wichita, Kan. Est. $1,500,000 to $2,000,000. Noted Aug. 7, under "Unclassified, Texas and Illinois, Contracts Awarded."

WAREHOUSES

PROPOSED WORK

Calif., Los Angeles—Braun Corp., 363 New High St., plans by Walker & Eisen, Western Pacific Bldg., 2 story, 85 x 400 ft., warehouse, brick, concrete, heavy mill constr., East 15th St.

Pa., Pittsburgh—Duquesne Warehouse Co., subsidiary Pennsylvania R.R. Co., Broad St. Sta., Phila., T. J. Skillman, ch. engr., 10 story, brick, steel warehouse, dry and cold storage facilities, 10th and Pennsylvania Sts.

BIDS ASKED

Nev., Reno—Southern Pacific R.R. Co., G. W. Boschke, ch. engr., 65 Market St., San Francisco, Calif., taking bids 40 x 268 ft. freight shed with loading platform, steel umbrella roof; 42 x 72 ft. office building.

N. J., Newark—New Jersey Bell Telephone Co., 540 Broad St., bids about May 15, general contract 6 story, basement, brick, steel warehouse, garage, Fabyan Pl. and Loretta Ave. $750,000. Voorhees, Gmelin & Walker, 101 Park Ave., New York, archts. Noted Mar. 26.

CONTRACTS AWARDED

N. Y., New York—Port of New York Authority, 80-90 8th Ave. excavation and founds. for freight terminal, to Godwin Constr. Co., 370 Lexington Ave., $855,000. Noted Jan. 8.

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See proposal advertising on page 98